VOLUME : 12 NUMBER : 2-3 MAY-SEP. : 1983

THE JOURNAL OF TURKISH

PHYTOPATHOLOGY

Published by the Turkish Phytopathological Society

The Journal of Turkish Phytopathology is published once every four months. Three parts form a volume. The subscription price of a volume is $ 13.00

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Doğruluk Matbaacılık ve Tic. Koll. Şti. - İZMİR
1983

J. Turkish Phytopath., Vol. 12, No. 2-3, 49-60, 1983.

Investigations on the Effects of Various Soil Sterilization Types and Some Fungicides Used in Vegetable Seedbeds and Greenhouses to Soil Mycoflora in Ege Region[1]

I. Greenhouse studies

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ABSTRACT

The present study has been conducted in Ege Region in order to determine the effect on soil mycoflora caused by several fumigants and steam which were used for soil sterilization and also systemic fungicides used for the control of powdery mildew. In addition to this, effects of pesticides and steam on the physical and chemical qualities of soil were also investigated.

Experiments were carried out in the greenhouses of Gümüldür, Torbalı and Agricultural Faculty of Ege University.

At the end of the studies 35 fungi were established.

INTRODUCTION

Applications of the pesticides to soil and plant continiously against diseases and pests cause the change of soil-nature and natural balance. The effects of these applications on disease agents, the other soil microorganisms and the physical and chemical qualities of soil, are reported in many papers (Katznelson and Richardson 1943, Warcup 1951, Kreutzer 1960, Lily 1965, Page and Craddock 1965, Mughogho 1963, Smith 1963, Hoper et al 1971, Kastra and Gams 1973, Bollen 1974, Warcup 1976, Rai and Tiwari 1977).

This study has been carried out in order to determine the effect on soil mycoflora caused by Formalin, Methylbromide fumigants and steam which were used for soil sterilization and also systemic fungicides used to control of powdery mildew. Also the effects of pesticides and steam on the physical and chemical properties of soil were examined.

(1) This study was supported by the Scientific and Technical Research Council of Turkey (Ankara-TOAG 364)

MATERIALS AND METHODS

Methylbromide (100 gr/m2), Formalin (300 cc/m²), Benlate (60 gr/100 lt water), Enovit-Super 40 gr/100 lt. water) and steam soil samples, various laboratory means and necessities and chemical substances have been the materials of this study.

These experiments were conducted in green houses with steam, Methylbromide, Formalin and systemic fungicides as, Benlate and Enovit-Super.

In greenhouse experiments, soil samples were taken from 0-30 cm. depth of soil according to the Mercdith's (1940) method.

Steam experiment was carried out at 130°C and three atmosphere pressure for four hours period in greenhouse at Gümüldür. Soil samples were taken twice as before and 10 days after steaming.

Methylbromide and Formalin experiment was established at Agricultural Faculty of Ege University. In greenhouses treated with Methylbromide and Formalin, soil samples were taken five times as follows: before applying fumigant, after applying and airing and then one, two and three monts later.

Systemic fungicides experiment was carried out at Torbalı in greenhouse. Soil samples were taken three times, before applying and one week after applying as transplant-water and one week later at the end of three foliar sprayings with 15 day intervalls.

Soil samples were cultured as soil-plate (Warcup, 1950) foı all fungi, soil dilution-plate for **Phytophythora** spp. (Johnson et al 1959) and trapping method for **Rhizoctonia solani** Kühn. (Papavizas and Davey, 1967). Peptone Dextrose Agar + Rose Bengal + Streptomycine + Peniciline medium was used for all fungi. 1 % PDA + BNPRA and Water agar media were used for **Phytophthora** spp. and **R. solani** respectively.

Mycoflora studies were conducted in the growth chamber at 24 + 2 C°. Petri dishes were examined after three days incubation and each fungal colony was counted, recorded and identified as in per gr airdry soil.

Trapping method was employed for **R. solani**. Five pieces of a trap plant were placed into the dishes, in five replications. The percentage of **R. solani** was found by considering the average of five replications.

On the other hand, the soil samples were analysed from physical and chemical standpoint at Toprak-Su Bölge Müdürlüğü in İzmir.

RESULTS

Results of the experiments performed with steam at Gümüldür: **Alternaria, Aspergillus, Cladosporium**, Drechslera, Fusarium, Helminthosporium, **Penicillium, Pythium, Scopulariopsis, Stachybotrys, Streptomyces, Stemphylum, Trichoderma** and genera belonging to the

Mucorales order are isolated from the steam sterilized greenhouse soil. After applying steam, **Fusarium** spp. and **Alternaria** spp. fungi were dominant colonizer and steam affected the fungi quantitatively. Especially the number of **Aspergillus** species significantly decreased after steaming. Before steaming **Streptomyces** sp. and **Trichoderma** sp. were not detected, but after steaming they were found.

In the steam experiment, the total population of fungi were given in Figure 1 and the percentage of **R. solani** in Figure 2.

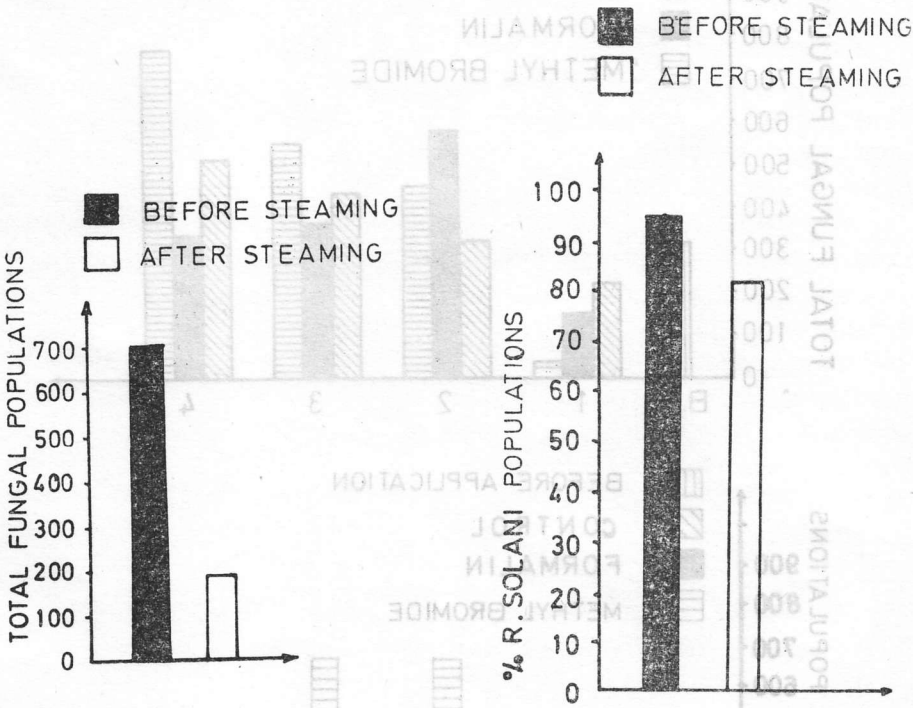

Fig. 1-2. Total population of fungi and the percentage of **R. solani** in steam sterilized greenhouse (1978, Gümüldür).

As shown in Figure 1, 10 days after steaming it was seen that, steam affected the fungi quantitatively and it caused to decrease the total number of fungi considerably. After steaming, **R. solani** was affected as shown in Figure 2.

Results of greenhouse experiments treated with fumigants:

Actinomucor, Alternaria, Aspergillus, Botryotrichum, Cephalosporium, Chaetomium, Cladorrhinum, Cladosporium, Fusarium, Gelasinospora, Gilmaniella, Gliocladium, Humicola, Melanospora, Myrothecium, Paecilomyces, Papulaspora, Penicillium, Phoma, Pythium, Scopulariopsis, Sordaria, Thielavia, Trichoderma, Ulocladium, Sterile, certain unknown fungi and genera belonging to the Mucorales order are isolated from the Formalin and Methylbromide applied soils. **Peni-**

cillium spp., **Aspergillus** spp., **Fusarium** spp., **Trichoderma** spp. and **Botryotrichum** spp. genera took place in the first rows among them in this experiment.

In the greenhouse experiments done in 1978 and 1979 the total population of fungi are given in Figure 3 and 4, the percentage of **R. solani** in Figure 5 and 6.

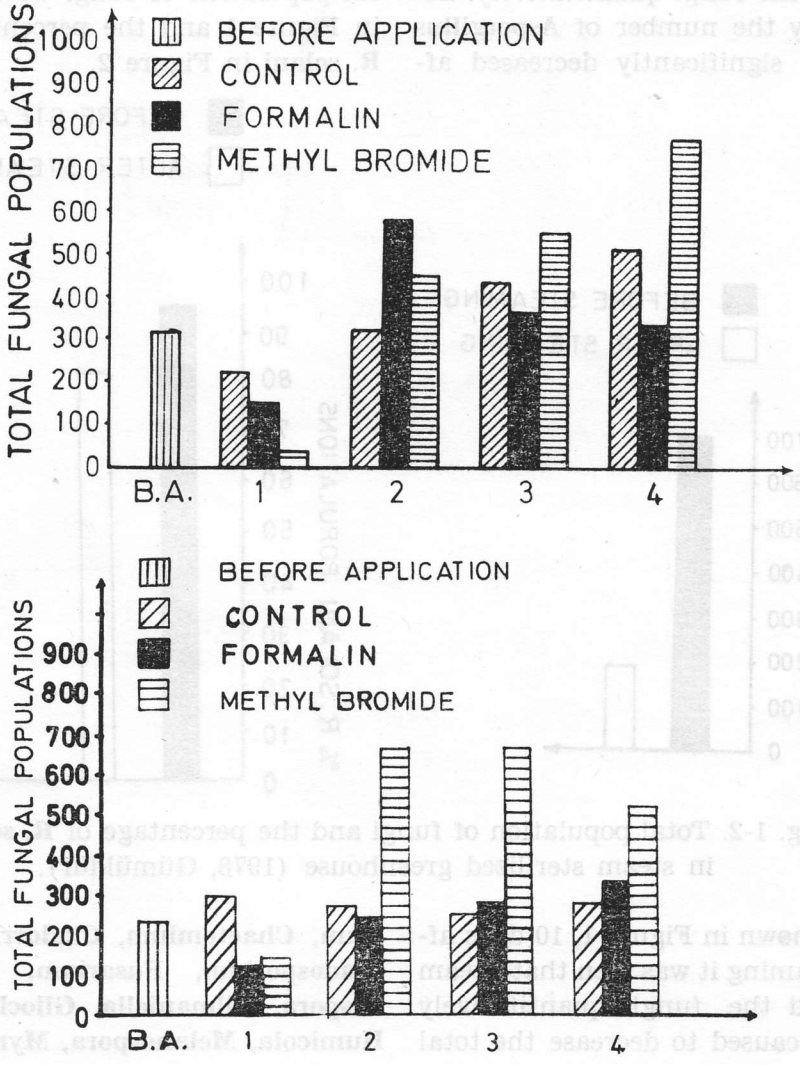

Fig. 3-4. The total population of fungi in Formalin and Methybromide applied tomato greenhouses (Faculty, 1978-1979).

Both of the fumigants were found effective on **R. solani** in both years. This effect continued throughout the experiment.

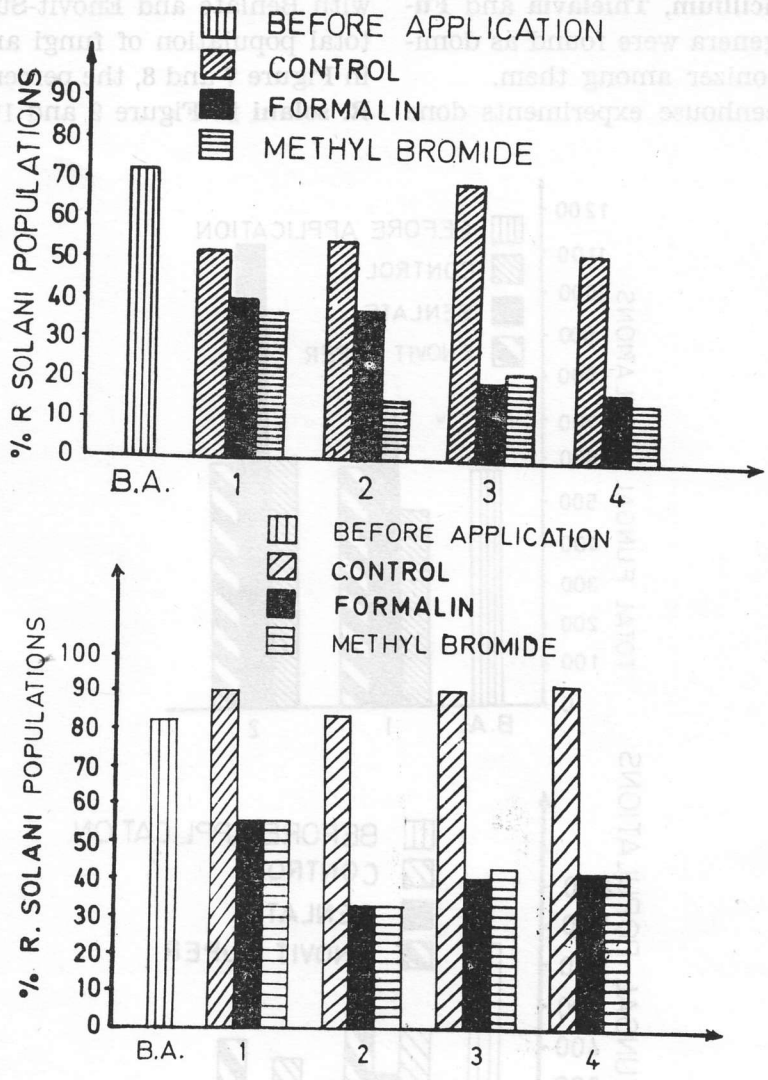

Fig. 5-6. The percentrage of **R. solani** in fumigants applied tomato greenhouses (Faculty 1978, 1979).

Results of the greenhouse experiments carried out with systemic fungicides:

In our experiments done with Benlate and Enovit-Super in 1978 and 1979, **Actinomucor, Aspergillus, Botryotrichum, Cephalosporium, Chaetomium, Cladosporium, Cladorrhinum, Drecshlera, Fusarium, Gilmaniella, Gliocladium, Humicola, Myrothecium, Paecilomyces, Papulospora, Penicillium, Pythium, Phytophthora, Scopuloriopsis, Stachybotrys, Thielavia, Torula, Trichoderma, Ulocladium,** unknown steril and genera belonging to the Mucorales order were isolated. **Aspergil-**

lus, Penicillium, Thielavia and **Fusarium** genera were found as dominant colonizer among them.

In greenhouse experiments done with Benlate and Enovit-Super the total population of fungi are given in Figure 7 and 8, the percentage of **R. solani** in Figure 9 and 10.

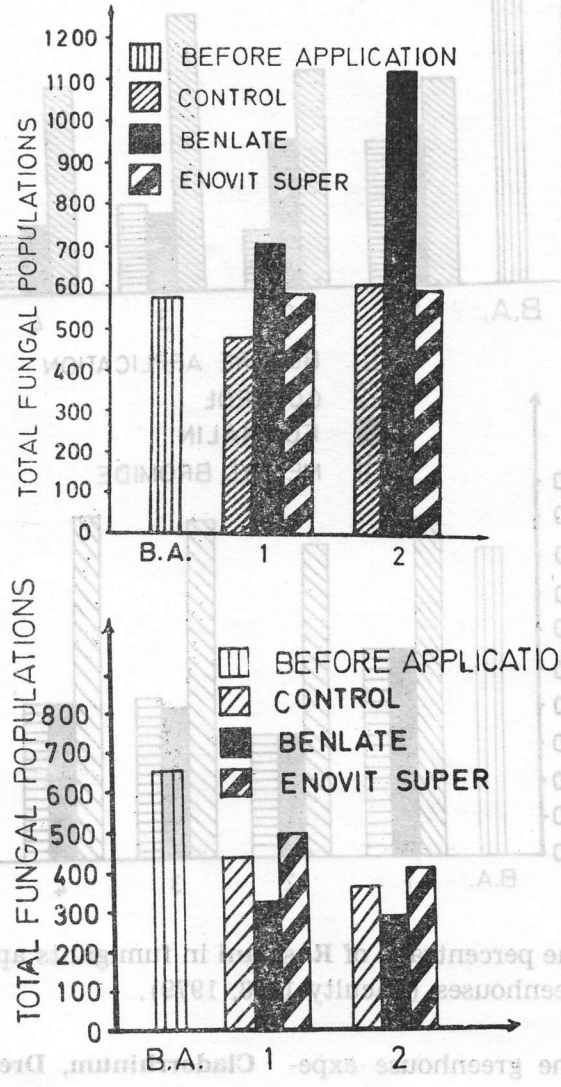

Figure 7-8. The total population of fungi in systemic fungicides applied cucumber greenhouse (Torbalı, 1978-1979).

It was found that, when the Benlate and Enovit Super applied as transplant water in both years, they affected **R. solani** as shown in Figure 9 and 10.

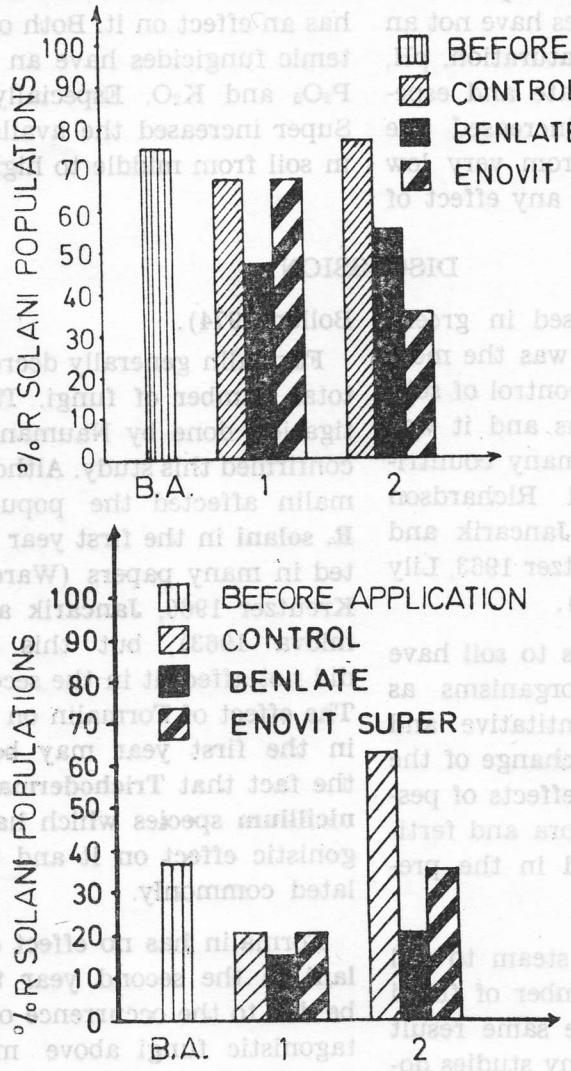

Figure 9-10. The percentage of **R. solani** in systemic fungicides applied cucumber greenhouse (Torbalı, 1978-1979).

The effects of pesticides and steam on the physical and chemical properties of soil were also investigated.

Steam has not an effect on saturation ,salt, pH, lime and organic matter, but increased available P_2O_5 and significantly decreased K_2O in soil.

Formalin and Methylbromide have not an important effect on saturation, pH, lime, organic matter, P_2O_5 and K_2O, but generally decreased the salt concentrations.

Benlate and Enovit-Super from the systemic fungicides have not an important effect on saturation, pH, organic matter, Benlate and especially Enovit-Super increased the salt concentrations from very low to high. There is not any effect of Benlate on lime but Enovit-Super has an effect on it. Both of the systemic fungicides have an effect on P_2O_5 and K_2O. Especially Enovit-Super increased the available P_2O_5 in soil from middle to high level.

DISCUSSION

Soil sterilization used in greenhouses and seedbeds, was the most effective method for control of soilborne plant pathogens and it was used successfully in many countries (Katznelson and Richardson 1943, Warcup 1951, Jancarik and Temmlova 1963, Kreutzer 1963, Lily 1965, Mughogho 1968).

Various applications to soil have an effect on microorganisms as qualitative and quantitative and this result cause the change of the natural-balance. The effects of pesticides on soil mycoflora and fertility were investigated in the present study.

The application of steam to soil effected the total number of fungi and decreased it. The same result was also found in many studies done by Katznelson and Richardson (1943), Warcup (1951), Sanford (1959) and Lily (1965). The fact that steam has little, if any effect on **R. solani** may be due to appearance of some antagonistic fungi such as **Trichoderma** and **Streptomyces** after steaming. As a matter of fact many workers were found that after steaming **Trichoderma** species have recolonized very easily (Warcup 1951, Sanford 1959, Lily 1965, Bollen 1974).

Formalin generally decreased the total number of fungi. The investigation done by Naumann (1970) confirmed this study. Although Formalin affected the population of **R. solani** in the first year as reported in many papers (Warcup 1951, Kreutzer 1960, Jancarik and Temmlova 1963), but this chemical did not affect it in the second year. The effect of Formalin on **R. solani** in the first year may be due to the fact that **Trichoderma** and **Penicillium** species which have antagonistic effect on it and were isolated commonly.

Formalin has no effect on **R. solani** in the second year this may be due to the occurrence of the antagonistic fungi above mentioned in a few number.

As reported by Wuest and Schisler (1970) in the present study, it was found that Methylbromide increased the population of fungi due to the fact that the **Penicillium, Botryotrichum, Aspergillus** and **Trichoderma** species were dominant recolonizer. Actually it was also found that in our seedbed experiments (Part 1), Methylbromide increased the total population of

fungi by stimulating them. The decrease of the population of **R. solani** by Methylbromide in both year may be due to the dominant recolonization of antagonistic fungi such as **Penicillium** and **Trichoderma** after application. This finding is very important from the standpoint of biological control of soil pathogens.

After applying systemic fungicides **Aspergillus, Penicillium, Thielavia** and **Fusarium** species took place in the first rows among them. Kaastra and Gams (1973) found that after applying Benlate, **Penicillium** and **Fusarium** species were dominant recolonizer as in our experiments. Although some workers recorded that Benlate did not affect the total population of fungi (Hofer and Wallnofer, 1971; Kaastra and Gams 1973, Raynal and Ferrai 1973, Peeples 1974) in this study it was found that Benlate affected it. Actually, this result was also found by Ponchet and Traimer (1972), according to the Berg and Bollen (1971) Kaastra and Gams (1973), Faassen and Van (1974), Oku et al (1979) as determined in our studies. Benlate and Enovit-Super decreased the population of **R. solani** according to the control, this result may be due to fungicidal effects of these systemic fungicides and dominant recolonization of antagonistic fungi such as **Trichoderma, Aspergillus** and **Penicillium** which were effective on **R. solani.** As a matter of fact, the same result was found by Oku et al (1979).

It was found that pesticides affected both soil mycoflora and physical and chemical qualities of soil in the other countries (Kreutzer 1960, Page and Craddock 1965, Smith 1968, Hoper et al 1971).

In the present study steam has not any effect on salt, pH, lime, organic matter, but increased the amount of available P_2O_5 in soil from low to moderate, but decreased the amount of K_2O from very high to high. This decrease may be due to the fixation of (K) in the soil because of heat during the steaming (Turguttopbaş, 1975). This result showed that steam has a good effect on soil chemical.

In the present study Formalin and Methylbromide have not an important effect on sauration, pH, lime, organic matter and K_2O, but decreased the salt concentration in soil as in our seedbed experiments. Actually, it was recorded that fumigants can change the salt as qualitatively and quantitatively (Kreutzer, 1970). It was found that Formalin and Methylbromide have not an important effect on the amount of available P_2O_5, but Page and Craddock (1965) and Smith (1968) recorded the fumigants increased P_2O_5 in soil extract.

Systemic fungicides have not any effect on saturation, pH, lime and K_2O but significantly increased the salt concentration in soil. As its known, the increase of the salt concentration prevents the plant from growing and using of nutrients. Separately, systemic fungicides have also negative effect on physical

quality of soil (Güner, 1971). Considering systemic fungicides used on a large scale in greenhouses in recent years, may cause some problems from the salt concentration point in the years to come, it follows from this that it must be studied on this subject matter in detail. Although it was found that Benlate and Enovit-Super have not significant effect on organic matter. Hoper et al (1971) recorded that Benomyl increased the organic matter decompostion. The another important effect of systemic fungicides is on the amount of P_2O_5 and increased it. This result is important from plant growing standpoint.

As a result, it was found that the pesticides and steam effected the soil mycoflora and physical and chemical qualities of soil in different ways.

In some applications increase of antagonistic fungi such as **Trichoderma** spp., **Aspergillus** spp. and **Penicillium** spp. are of important for biological control. In addition to this, after applying of systemic fungicides the increase of salt concentration is also another important point.

Ö Z E T

EGE BÖLGESİ SEBZE FİDELİK VE SERALARINDA UYGULANAN ÇEŞİTLİ TOPRAK STERİLİZASYON TİPLERİ İLE BAZI FUNGİSİTLERİN TOPRAK MİKROFLORASINA ETKİLERİ ÜZERİNDE ARAŞTIRMALAR

II. Seralarda Yürütülen Çalışmalar:

Bu çalışma Ege Bölgesi seralarında toprak sterilizasyonunda kullanılan çeşitli fumigant ve su buharı ile külleme savaşımında uygulanan sistemik fungisitlerin toprak mikoflorasına etkilerini saptamak amacıyla ele alınmıştır. Bunun yanısıra kullanılan pestisitlerin ve su buharının toprağın fiziksel ve kimyasal özelliklerine etkileri de incelenmiştir.

Denemeler Gümüldür, Torbalı ve Ege Üniversitesi Ziraat Fakültesi seralarında yürütülmüştür.

Çalışmalar sonunda 35 fungus genusu saptanmıştır. Uygulanan ilaçlardan Formalin, Benlate, Enovit-Super ve su buharı genellikle toplam fungus sayısını azaltmış, Metilbromit ise arttırmıştır.

Su buharı saturasyon, tuz, pH, kireç ve organik madde üzerinde etkili olmadığı halde, P_2O_5 miktarını arttırırken, K_2O'yu bir hayli düşürmüştür. Formalin ve Metilbromit saturasyon, pH, kireç, organik madde, P_2O_5 ve K_2O üzerinde önemli bir değişikliğe neden olmamalarına karşın, genellikle tuz konsantrasyonunu düşürmüşlerdir. Benlate ve Enovit-Super ise saturasyon, pH, organik madde üzerinde önemli derecede etkili olmamış, fakat Benlate ve özellikle Enovit-Super topraktaki tuz oranını azdan çok fazlaya yükseltmişlerdir. Her iki sistemik fungisit gerek P_2O_5 ve gerekse K_2O miktarını arttırmışlardır.

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J. Turkish Phytopath., Vol.: 12, No. 2-3, 61-71, 1983.

Investigations on the Determination of Rice Diseases Caused by Fungi, Their Distribution, Prevalance and Incidence, Overwintering in the Aegean Region of Turkey.

I - Determination of Rice Diseases, Causal Agents and Distribution Prevalance and Incidence:

Mustafa COPÇU* and İbrahim KARACA**

ABSTRACT

At the end of two-years' survey studies in the provinces of the Aegean Region (Aydın, Balıkesir, Çanakkale, Denizli, İzmir and Manisa), Blast (**Pyricularia oryzae** Cav.), Brown Leaf Spot (**Helminthosporium** spp.), Minute Leaf Spot (**Nigrospora oryzae** «Berk.-Br.» Petch). and Foot-rot (**Fusarium moniliforme** Sheld.) diseases were determined in rice fields.

Rice blast disease was determined only in Balıkesir and Manisa provinces and its incidence was 7.7 % on average. Blast incidence in the infected rice fields varied between 42.34 - 1.28 %. Rice variety Maratelli was found more susceptible than the others.

Brown Leaf spot was observed in all surved provinces except Manisa. Its prevalance was 35.8 % in the Aegean Region during 1974 and 1975 rice growing seasons. Disease incidence in the infected fields was also found between 10.06 - 0.14 %. **Helminthosporium oryzae** Breda de Haan, **H. sativum** Pamm., King and Bakke, **H. monoceras** Drechsl., **H. australiense** Bugn., **H. dematioideum** Drechsl. and **H. pedicellatum** Henry were isolated from the brown leaf spots. According to the pathogenicity studies carried-out with Baldo and Ribe rice varieties, **H. oryzae** Breda de Haan, **H. sativum** Pamm., King and Bakke and **H. monoceras** Drechsl. were main causal agents of the disease.

From the minute leaf spots **Nigrospora oryzae** (Berk-Br.) Petch., **Alternaria tenuis** Auct., **Curvularia geniculata** (Tr.-Earle), **C. lunata** (Wakker) Boed. and **C. pallescens** Boed. were isolated. According to the inoculation tests, the first two species particularly **N. oryzae** (Berk.-Br.) Petch. were primary causal organism of the minute leaf spots.

Foot-rot disease (**Fusarium moniliforme** Sheld.) of rice was detected only in northern provinces (Balıkesir and Çanakkale) of the region. It was showed with typical Bakanea symptoms and its severity was less than 5 %.

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INTRODUCTION

Rice is equal nearly same in importance of wheat as a world food crop. It is the stable food for half of the world's population. Rice production is very important especially in the improving countries for human feeding. It has some advantages among cereals such as high performance, more profit and suitability for unfavourable soil conditions. However there are some environmental conditions that limits rice growing areas such as lack of irrigation water in Turkey.

Rice yield per unit area vary considerably from one country to another because of different cultivation techniques, rice varieties and insect pest and diesases. The yield levels ranged from 0,5 to 6.5 tons per hectare (Jung and Yamada, 1972). The annual crop losses caused by insect pests, diseases and weed was approximately estimated as 46 % (Cramer, 1967). In the recent years the productions of the other cereals has been significantly increased, but any increase of rice production can not be seen in Turkey.

Some studies have been carried-out on the rice diseases in Turkey. The causal agents, their morphological characters and symptomatology of the rice brown leaf spot were recorded (İren, 1968). Oran et all. (1973) presented the chemical control possibilities for the blast disease by means of laboratory and field experiments and determined the effective fungicides. By another study, the annual yield losses caused by **Pyricularia oryzae** was estimated as 8,33 % for the Southeastern part of Turkey (Oran, 1975). But it has not been completely presented for all over the country and it is still unknown for some regions.

In the first part of this study that carried out during 1974-1979, the rice diseases caused by fungi, their fungal agents, distribution, prevalance and incidence were determined in the Aegean Region. In the second part the overwintering of the causal organisms was investigated from the point of seed, soil and plant debris remained in the rice-fields.

MATERIALS and METHODS

Survey studies were carried-out in the rice fields of Aydın (Söke), Balıkesir (Bigadiç, Gönen, Manyas, Sındırgı), Çanakkale (Biga), Denizli (Sarayköy), İzmir (Menemen) and Manisa (Turgutlu), provinces of the Aegean Region. They were repeated on 3 growth stages namely as seedling-tillering, elongation-booting and ripening in the same-fields. During the survey studies 106 rice fields were examined. All parts of the rice plants (stem, leaves, panicles) were observed at 5 points of the fields and infection ratio was determined.

Isolation studies were carried-out with the diseased plant parts by

blotter and agar techniques. Pure cultures were obtained by single spor isolations on Potato Dextrose Agar slants. Some of them was identified by Dr. Von Arx. Their pathogenicities were presented by seedling tests under the green house conditions.

RESULTS

1. Symptoms of the Diseases :

The first occurrence of the blast (**Pyricularia oryzae** Cav.) was observed as leaf spots at the tillering stage of the rice plants. On the later examinations the blast incidence raised and maximum ratio was obtained on booting and flowering stages. Although any scale was not applied for disease evaluation, number and size of the leaf blast symptoms were increased according to the plant age. At the begining of the plant growth, leaf blast symptoms were circular or oblong and reddish brown minute spots. Later the centre of the spots was usually grey or whitish and the margin is generally brown or reddish brown. They were typically eliptical. The spots enlarged under favourable conditions. Numerous spots occured on an old leaf which was soon killed. When the rice plants were at booting or flowering stages, node blast was also observed in some fields. First or second node above irrigation water level was blackened and plants remained connecting by the nodal septum only. After harvesting the infected plants with node blast were easily recognized in the same fields. During the survey studies only one rice plant with neck blast was in Balıkesir (Gönen County) and sheath infection like leaf blast symptoms was also rarely observed on a few rice plant (Fig. 1).

On all of the growth stages from seedling to ripening, brown leaf spot symptoms were obviously detected on the rice leaves as minute brown dots and ellipsoidal or oval to circular large spots with light or dark brown or reddish brown colour (Fig. 2). At the ripening stage the typical symptoms of the brown leaf spot were also occurred on the panicle of the plants.

Minute leaf spots were often found on the leaves from the tips which weakened by various reasons (i.e. lack of nutriotinal elements or irrigation water). The characteristic symptoms were the presence of numerous, minute, dark, reddish-brown, or black pustules less than 0,5 mm in diameter on the leaves. The leaves sometimes dried and killed later (Fig. 3).

Foot-rot or Bakanae disease could be detected with visible symptoms especially at the end of the elongation stage to ripening. The main symptom was abnormal stem elongation of diseased plants. Infected plants had no tillers or only a small number of tillers (suchas 1 or 2) and dried up earlier than the healthy plants. After drying, a

white or pinkish mycelial growth of the causal organism could be easily seen on the lower parts (especially on first or second node of the stem) of the rice plants. More adventitious roots were also formed from these lower nodes of infected rice plants (Fig. 4).

2. Distribution, prevalance and incidence of the diseases :

No visible disease caused by fungi was obtained 18.2 % of the examined fields in 1974. Ratio of the infected fields with brown leaf spot, minute leaf spot, footrot and blast were observed in 41,4; 45,5; 27,3 and 5,5 percent of the examined fields in the same year respectively.

In the second year it was not observed any fungal disease in 19.6 % fields examined. The diseases mentioned above were determined in 29,4; 43,1; 15,7 and 9,8 percent of the fields.

The review of the survey studies are given in Table 1. The prevalance of the minute leaf spot on Baldo and Ribe rice varieties were 22.2 % and 52.2 % respectively in second year. Brown leaf spot occurcence was 24,5 % 39.1 % in 1974 and 42.1 % and 20,0 % in 1975 respectively on the rice varieties mentioned above. The average of the Bakanae disease prevalance for the region was 66,7 % and 31.6 % in 1974 and 19,6 % and 3,3 % in 1975 on Baldo Ribe verieties respectively (Table 1).

The incidence of the diseases in the rice fields were also shown according to the plants growth stages in Table 2 and 3. It is shown that there is not any significantly important difference between the disease rates obtained on seedling-tillering and booting-flowering stages (Table 2 and 3).

3. Causal agents of the diseases :

By means of the laboratory studies and the results of the pathogenicity tests the causal organisms of the diseases were presented as follows:

Blast : **Pyricularia oryzae** Cav.

Brown leaf spot : **Helminthosporium oryzae** Breda de Haan

» **monoceras** Drechsl .

» **sativum** Pamm., King and Bakke

» **australiense** Bugn.

» **dematioideum** Drechsl.

» **pedicellatum** Henry

Minute leaf spot : **Nigrospora oryzae** (Berk-Br.) Petch.

Foot-rot (Bakanae) : **Fusarium moniliforme** Sheld.

DISCUSSION

The rice diseases caused by fungi, their fungal agents, distributions in the Aegean Region and their prevalance and incidence in the rice fields were presented by this study. According to the provinces examined, the prevalance and incidence of some disease composition was significantly different. In the northern parts of the region particularly in Balıkesir province blast and foot-rot diseases were prevalent and any important difference was not obtained on the other diseases between the rice field's localities. Although any spesific study was not carriedout on the epidemiology of the diseases, it was obvious that the main effect on this differantation was due to the environmental conditions. For example in Balıkesir province (Gönen County, Sarıköy village) the most infected rice fields are in the valley that relative humidity is very high during the rice growing season and the weather is usually cloudy. These weather conditions are favourable for the pathogen as well as unfarourable for rice growing. But the blast was also found in only Manisa province which is the southern part of the region. In that infected rice field which was planted with Maratelli variety as the second crop after wheat harvest. According to the results of both previous studies (Oran, 1975) and our pathogenicity tests, Maratelli is the most susceptible rice variety to blast. On the other hand irrigation water that supplied from deep-well was more cooler than channel's water and this irrigation system was harmfull for rice growing. These conditions also occurred as more favourable conditions for the fungus and infection process. In conclusion it may be said that blast is not very prevalent over the region, but the pathogen has an economical importance from the point of view of the crop losses. This harmfull effect was also observed in recent years in some individual rice fields (i.e. the infection ratio increased 100 % and crop losses were approximately 30 % in the rice field in 1981).

Although brown leaf spot disease distributed on all over the rice fields in the region, its incidence was usually lower. Pathogens of the disease were different among the fields or the plants of the same field. Out of the 6 species isolated from infected rice leaves 3 species have been determined as main pathogens. They were **Helminthosporium oryzae** Breda de Haan, **H. sativum** Pamm., King and Bakke and **H. monoceras** Drechsl. Some workers reported that the pathogens of the brown leaf spot caused foot-rot and kernel discolorization. (Fazlı, and Schoeder, 1966; Iren, 1968). The leaf spots were generally observed in the Aegean Region. Under the natural conditions the characters the characters of the leaf spots were not different according to the causal

agent species. **H. oryzae** Breda de Haan, **H. halodes** Drechsl. and **H. rostratum** Drechsl. were found as brown leaf spots pathogen by the previous study in Turkey (Iren, 1968). In that study **H. monoceras** Drechsl. was also isolated from **Panicum crusgalli** L. in the rice fields. The isolations of **H. sativum** Pamm., King and Bakke, **H. australiense** Bugn., **H. dematiodieum** Drechsl., **H. pedicellatum** Henry and **H. monoceras** Drechsl. from infected rice leaves in the present work is the first record for Turkey. Anonymous (1967) and Walker et all. (1968) reported that **H. sativum** Pamm., King and Bakke caused the leaf spots on rice. Bugnicourt (1955) first isolated **H. australiense** Bugn. from rice seeds. Isolation of the fungus from rice leaves is the first record. Putteril (1954) determined that **H. dematioideum** Drechsl. occured on **Cynodon dactylon** L., **C. bradleyi** L. and **C. transvaalensis** L. and Fesli (1975) isolated the fungus from rice seeds. As a result the fungus was first recorded on the rice plants by this study. On the other hand **H. monoceras** Drechsl. was first presented as an important pathogen under the natural conditions.

Minute leaf spot was observed on all over the rice growing stages with different incidences. But it was most prevalent in Aydın and Denizli provinces. It was observed on weakened leaves especially on the leaf tips and margins. Isolation studies resulted some fungi, but only two of them **Nigrospora oryzae** (Berk.-Br.) Petch. and **Alternaria tenuis** Auct. caused disease symptoms under greenhouse conditions. **N. oryzae** (Berk.-Br.) Petch. had been first recorded on wheat and cotton in Turkey (Bremer et all., 1948). However there are some studies carried-out with **Nigrospora** it may be said that detection of **N. oryzae** (Berk.-Br.) Petch. is the first record as a causal agent on the rice for Turkey.

Foot-rot or Bakanae disease was only observed on the northern part of the region. It was prevalent, but its severity was less than 5 % in the rice fields during the survey studies. The pathogen fungus was **Fusarium moniliforme** Sheld. Under natural conditions the disease was easily determined as Bakanae symptoms (abnormal stem elongation, lack of tillering, more adventitious root formation on lower stem nodes, early maturing and drying, mycelial growth and rotting on lower nodes). Ou (1975) reported that not all of infected plants had the Bakanae symptoms, some of them stunted depending upon the strains of the causal organism and environmental conditions. But the main symptoms of the foot-rot were Bakanae formation in the Aegean Region.

In consequence of the survey studies and pathogenicity tests which presented main casual organisms, distribution of the diseases over the region, their prevalance and incidence in the fields were obtained. On the second part of the study details of the tests carried-out under greenhouse conditions and overwintering ways of the pathogens will be given.

Ö Z E T

EGE BÖLGESİ ÇELTİK ALANLARINDA GÖRÜLEN FUNGAL HASTALIKLARIN SAPTANMASI, YAYILIŞ ORANLARI VE YILDAN YILA GEÇİŞLERİ ÜZERİNDE ARAŞTIRMALAR

I - Fungal Hastalıkların, Yayılışları ve Etmenlerin Saptanması :

Ege Bölgesi (Aydın, Balıkesir, Çanakkale, Denizli, İzmir ve Manisa illeri) çeltik ekim alanlarındaki fungal hastalıklar, etmenleri ve yaygınlık oranları iki yıllık (1974 ve 1975) survey çalışmaları ve laboratuvar ve sera testleri ile saptanmıştır. Survey çalışmaları sonunda Yanıklık (**Pyricularia oryzae Cav.**), Kahverengi Yaprak Lekesi (**Helminthosporium** spp.), **Nigrospora** Yaprak Lekesi (**Nigrospora oryzae** «Berk.-Br.» Petch.) ve Kökboğazı Çürüklüğü (**Fusarium moniliforme** Sheld) hastalıkları tesbit edilmiştir.

Yanıklık hastalığı sadece Balıkesir (Gönen ve Manyas) ve Manisa (Turgutlu) çeltik ekilişlerinde saptanmış ve ortalama yaygınlık oranı % 7,7 olmuştur. Tarlalardaki hastalık oranı ise % 1.28 - 42,34 arasında değişmiştir.

Kahverengi Yaprak Lekesi Manisa dışındaki diğer illerin çeltik ekilişlerinde görülmüş ve ortalama yaygınlık oranı % 35,8 olmuştur. İncelenen tarlalarda hastalık oranı % 0,14 - 10,06 arasında bulunmuştur. Hastalıklı çeltik yapraklarından **Helminthosporium oryzae** Breda de Haan, **H. sativum** Pamm., King and Bakke, **H. monoceras** Drechsl. **H. australiense** Bugn., **H. dematioideum** Drechsl., **H. pedicellatum** Henry fungusları izole edilmiş ve serada yapılan fide testleri sonucunda ilk üç fungusun esas hastalık etmeni olduğu saptanmıştır.

Yaygınlık oranı ortalama % 38,7 olan ve **Nigrospora** Yaprak Lekesi olarak tanımlanan yaprak lekelerinden başta **Nigrospora oryzae** (Berk.-Br.) Petch. olmak üzere **Alternaria tenuis** Auct., **Curvularia geniculata** (Tr.-Earle) Boed., **C. lunata** (Wakker) Boed ve **C. pallescens** Boed. türleri izole edilmiş ve patojenisite testlerinde öncelikle **N. oryzae** (Berk.-Br.) Petch. olmak üzere sadece ilk iki tür hastalık oluşturabilmiştir.

Kökboğazı Çürüklüğü sadece Balıkesir ve Çanakkale illeri çeltik tarlalarında ve ortalama % 21.7 yaygınlık oranında saptanmıştır. **Fusarium moniliforme** Sheld.'nin neden olduğu hastalık kaleme kalkma - olgunlaşma dönemleri arasında ve Bakanae sendromu (anormal bitki boyu uzaması, kardeşlenmenin olmayışı ya da çok az oluşu, erken olgunlaşma ve aklaşma, alt boğumlarda fazla adventif kök oluşumu ve beyaz ya da pembemsi fungal gelişme) içinde kolaylıkla görülebilmiştir.

Çalışmanın ikinci bölümünde hastalık etmenlerinin yıldan yıla geçişleri ortaya konacaktır.

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Table 1. Distribution and prevalance of the rice disease in the Aegean Region

Province	Rice variety	Number of examined fields		Ratio of infected rice fields (%)							
				Minute leaf spot		Brown leaf spot		Foot-rot		Blast	
		1974	1975	1974	1975	1974	1975	1974	1975	1974	1975
Aydın	Ribe	4	3	100.0	100,0	75.0	0.0	0.0	0.0	0.0	0.0
Balıkesir	Baldo	6	11	33.3	18.2	36.7	54.5	100.0	36.4	16.7	18.2
	Ribe	16	10	43.7	40.0	50.0	30.0	25.0	10.0	12.5	10.0
Çanakkale	Baldo	3	8	0.0	50.0	0.0	25.0	0.0	25.0	0.0	0.0
	Ribe	13	6	15.4	33.3	15.4	33.3	38.5	0.0	0.0	0.0
	Rocco	—	1	—	100.0	—	100.0	—	0.0	—	0.0
Denizli	Ribe	3	3	66.7	100.0	33.3	0.0	0.0	0.0	0.0	0.0
İzmir	Ribe	7	5	100.0	60.0	57.1	20.0	0.0	0.0	0.0	0.0
Manisa	Maratelli	—	1	—	100.0	—	0.0	—	0.0	—	100.0
	Ribe	3	3	66.7	0.0	0.0	0.0	0.0	0.0	0.0	33.3
Average of the region	Baldo	9	19	22.2	31.6	24.5	42.1	66.7	31.6	11.1	10.5
	Maratelli	—	1	—	100.0	—	0.0	—	0.0	—	100.0
	Ribe	46	30	52.2	50.0	39.1	20.0	19.6	3.3	4.3	6.7
	Rocco	—	1	—	100.0	—	100.0	—	0.0	—	0.0

Table 2. The ratio of infected rice plant during the tillering and elongation stages.

Province	Rice variety	Number of examined fields		Ratio of infected rice fields (%)							
				Minute leaf spot		Brown leaf spot		Foot-rot		Blast	
		1974	1975	1974	1975	1974	1975	1974	1975	1974	1975
Aydın	Ribe	4	3	7.9	2.1	1.3	0.0	0.0	0.0	0.0	0.0
Balıkesir	Baldo	6	11	1.0	0.1	2.4	0.9	0.1	0.4	0.0	0.4
	Ribe	16	10	3.2	3.6	1.0	0.4	0.0	0.0	0.2	0.7
Çanakkale	Baldo	3	8	0.0	1.5	0.0	0.6	0.0	0.1	0.0	0.0
	Ribe	13	6	0.2	0.6	0.1	0.5	0.0	0.0	0.0	0.0
	Rocco	—	1	—	2.0	—	0.6	—	0.0	—	0.0
Denizli	Ribe	3	3	10.7	18.9	0.8	0.0	0.0	0.0	0.0	0.0
İzmir	Ribe	7	5	7.3	9.3	0.4	0.0	0.0	0.0	0.0	0.0
Manisa	Maratelli	—	1	—	0.2	—	0.0	—	0.0	—	4.3
	Ribe	3	3	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average of the region	Baldo	9	19	0.7	0.7	1.6	0.8	0.1	0.3	0.0	0.2
	Maratelli	—	1	—	0.2	—	0.0	—	0.0	—	4.3
	Ribe	46	30	3.7	5.0	0.6	0.2	0.0	0.0	0.1	0.3
	Rocco	—	1	—	2.0	—	0.6	—	0.0	—	0.0

Table 3. The ratio of infected rice plants during the booting and ripening stages.

Province	Rice variety	Number of examined fields		Ratio of infected rice fields (%)							
				Minute leaf spot		Brown leaf spot		Foot-rot		Blast	
		1974	1975	1974	1975	1974	1975	1974	1975	1974	1975
Aydın	Ribe	4	3	25.9	22.1	2.4	0.0	0.0	0.0	0.0	0.0
Balıkesir	Baldo	6	11	0.0	0.1	1.9	0.5	0.8	0.4	0.2	0.1
	Ribe	16	10	2.2	4.1	0.4	0.4	0.1	0.1	0.2	0.1
Çanakkale	Baldo	3	8	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.0
	Ribe	13	6	0.1	0.4	0.1	0.0	0.2	0.0	0.0	0.0
	Rocco	—	1	—	2.2	—	0.6	—	0.0	—	0.0
Denizli	Ribe	3	3	20.8	19.3	0.8	0.0	0.0	0.0	0.0	0.0
İzmir	Ribe	7	5	8.2	14.5	0.2	0.9	0.0	0.0	0.0	0.0
Manisa	Maratelli	—	1	—	40.9	—	0.0	—	0.0	—	42.3
	Ribe	3	3	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average of the region	Baldo	9	19	0.0	0.1	1.3	0.3	0.5	0.3	0.1	0.6
	Maratelli	—	1	—	40.9	—	0.0	—	0.0	—	42.3
	Ribe	46	30	5.9	8.0	0.5	0.3	0.1	0.0	0.1	0.1
	Rocco	—	1	—	2.2	—	0.6	—	0.0	—	0.0

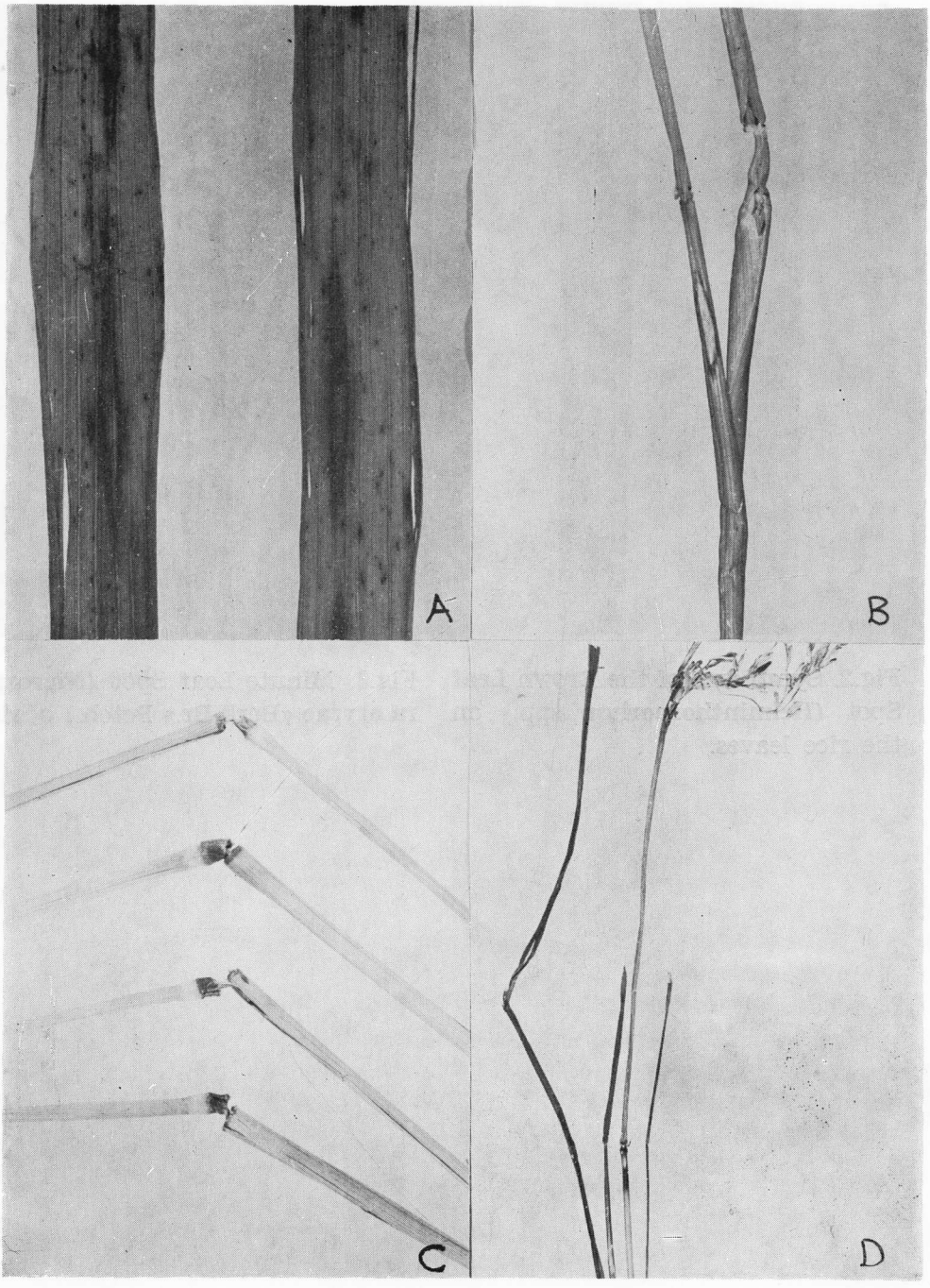

Fig.1. Blast (**Pyricularia oryzae** Cav.) disease of rice (A. Leaf blast B. Sheath symptoms C. Node blast D. Neck blast)

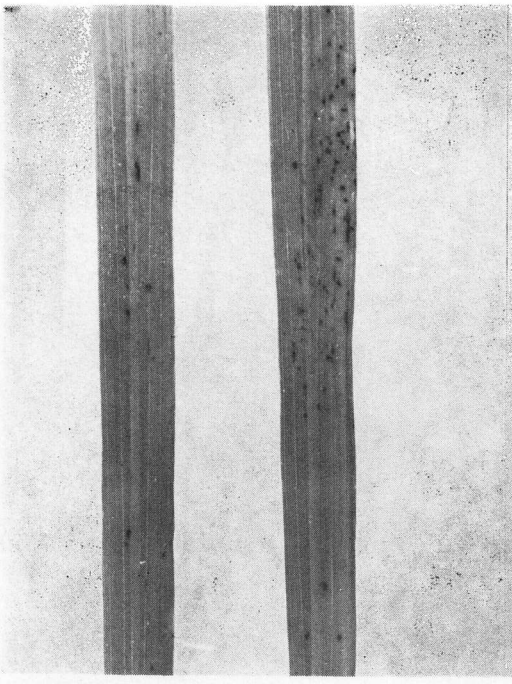

Fig.2. Symptoms of the Brown Leaf Spot (**Helminthosporium** spp.) on the rice leaves.

Fig.3. Minute Leaf Spot (**Nigrospora oryzae** «Berk-Br.» Petch.) of rice.

Fig.4. Foot-rot disease symptoms (Left: Abnormal elon gation and lack of tillering Middle: Rotten lower nodes of rice plant Right: Formation of adventitious root on the first node.)

J. Turkish Phytopath., Vol.: 12, No. 2-3, 73-75, 1983.

Investigations on the Determination of Susceptibilty of Some Gladiolus Cultivars Against Fusarium Corm Rot.

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ABSTRACT

Susceptibility of five Gladiolus cultivars (White prosperity, Blue Isle, Novalux, Victorborge and Praha)against **Fusarium oxysporum** and **F. solani** were investigated by the pot experiments. Novalux and Victorborge were highly susceptible to Fusarium corm rot, but white prosperity was not.

INTRODUCTION

The most serious disease effecting the growing of gladioli in many areas of the world is Fusarium corm rot or yellows caused by **F. oxysporum** f.sp. **gladioli** (Massey) Snyd. Hans (BRUHN, 1955; WOLTZ, 1974).

The cultivation of commercial ornamental plants in green houses have increased considerably, especially in suburbs of İzmir. According to 1980-1981 statistics the total area of the flower growing greenhouses is 511.082 m² in İzmir and it's suburbs, and the areas growing gladiolus have reached at 27.490 m² in the total areas of the ornamental plants. During the surveys, wilting and drying gladiolus plants were observed in 20 % of the examined area. As the result of isolations **F. oxysporum, F. equiseti** and **F. solani** were isolated from the diseased corms. According to the results of the pathogenicity tests, **F. oxysporum** and **F. solani** isolates caused decay of the corms, and drying of the above ground parts of the plants.

The study was carried out to determine the succeptibility of five gladiolus cultivars against **F. oxysporum** and **F. solani.**

MATERIAL and METHODS

Corms of five varieties of gladiolus (White prosperity, Blue ısle, Novalux, Victor borge and Praha) were chosen for their extreme susceptibility to **Fusarium** and were used in these experiments. The Fusaria used for inoculations was isolated from the lesions of diseased plant-corms. Pathogenicity tests had shown that these isolates (**F. oxysporum** and **F. solani)** were highly pathogenic.

Inoculum was prepared by growing the organism on potato-dextrose agar in petri dishes when the plates had been completely cove-

red with mycelium, they were mixed to sterilized soil. Each treatment was replicated seven times. Corms were surface sterilized in 0,5 % sodium hypochlorite for 10 min., and were planted in the pots.

Plant-emergence and rachis-length were recorded seven weeks after, corms were collected from all pots and the percentage of diseased area, visible rot and discolorations on them were recorded.

RESULTS and DISCUSSION

The results of the tests were given in Table 1.

Table 1. Effect of **F. oxysporum** and **F. solani** inoculations on shoot length and diseased area on corms of various gladiol cultivars.

Gladiolus cultivar	Plants emerged (No)	Shoot length (cm)	Diseased corm area (%)
White prosperity	7	21.4	0
» » (control)	7	39.0	0
Blue ısle	7	14.7	71.4
» » (control)	7	31.3	0
Novalux	7	5.0	100
» (control)	7	40.1	0
Vıctor borge	7	8.4	100
» » (control)	7	38.3	0
Praha	7	8.0	28,5
» (control)	7	38.3	0

The response of cultivars was different against the disease. White prosperity was apperently not susceptible to Fusarium corm rot although shoot growth was, somewhat, inhibited when compared with control (Fig. 1). Praha was moderately susceptible to corm rot, but it was recorded that its shoot development was highly inhibited (Fig. 2). Blue ısle was susceptible to corm rot, and development of shoot was poor (Fig. 3). Novalux and Vıctor borge-cultivars were highly susceptible to disease, and severe corm rot and inhibition of shoot growth were shown (Fig. 4 and 5).

Ö Z E T

BAZI GLADİÖL VARYETELERİNİN FUSARYUM KORM ÇÜRÜKLÜĞÜNE OLAN DUYARLILIĞININ SAPTANMASI

Denemelerde beş farklı Gladiöl varyetesi (White prosperity, Blue ısle, Novalux, Victorborge ve Praha)'nin daha önceki patojenisite testlerinde patojen bulunan **F. oxysporum** ve **F. solani**'ye karşı duyarlılıkları saksı koşullarında araştırılmıştır. Değerlendirmeler bitki boylarının ve kormlardaki hastalıklı alan yüzdelerinin saptanması suretiyle yapılmıştır. Deneme sonuçlarına göre, Novalux ve Victor borge varyeteleri yüksek duyarlı, White prosperity ise dayanıklı olarak bulunmuşlardır.

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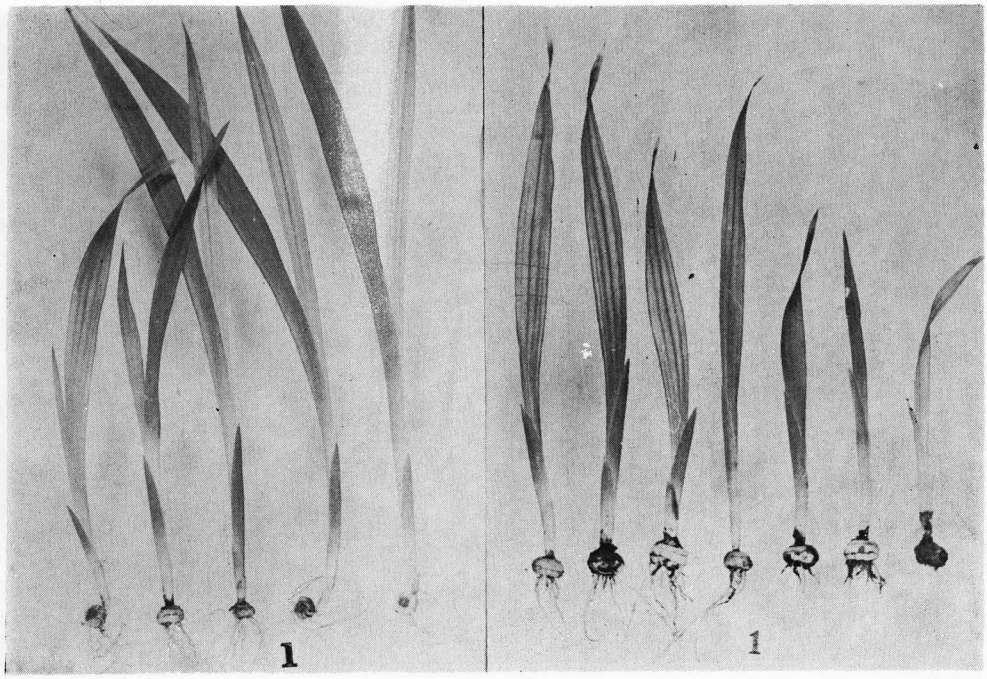

Fig.1. Infected and control gladioli plants of white prosperity variety (Control in left, diseased in right).

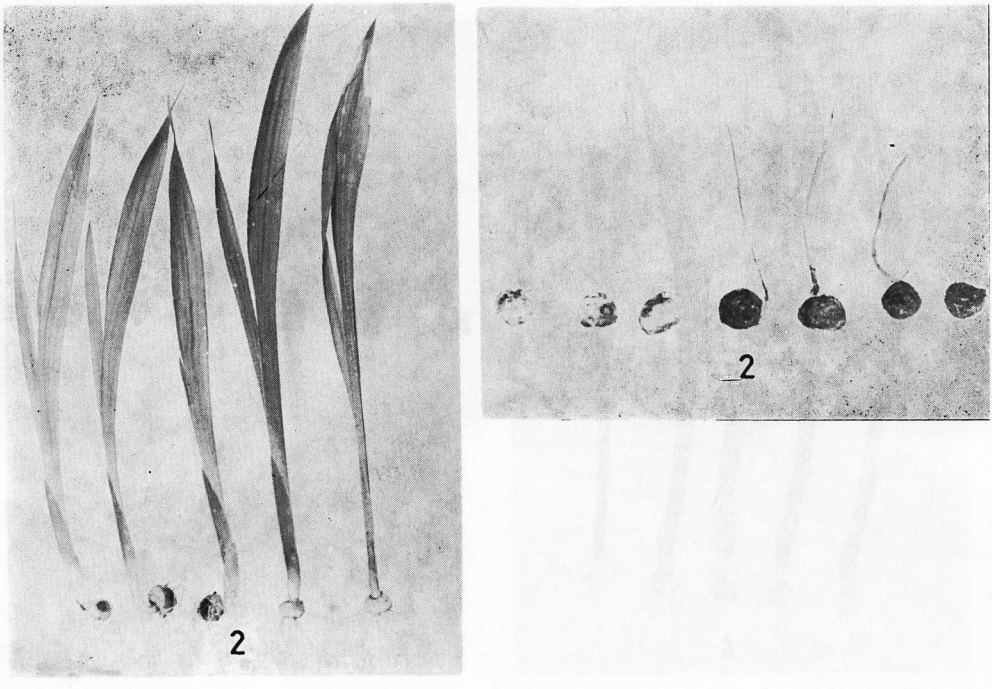

Fig.2. Infected and control gladioli plants of Praha variety (Control in left, diseased in right).

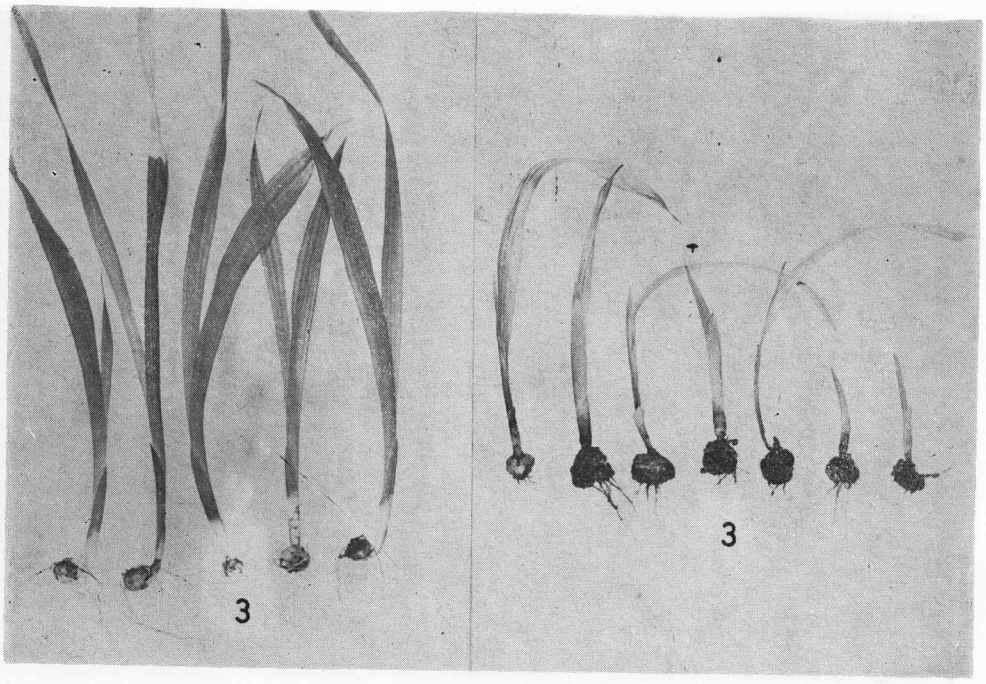

Fig.3. Infected and control gladioli plants of Blue ısle variety (Control in left, diseased in right).

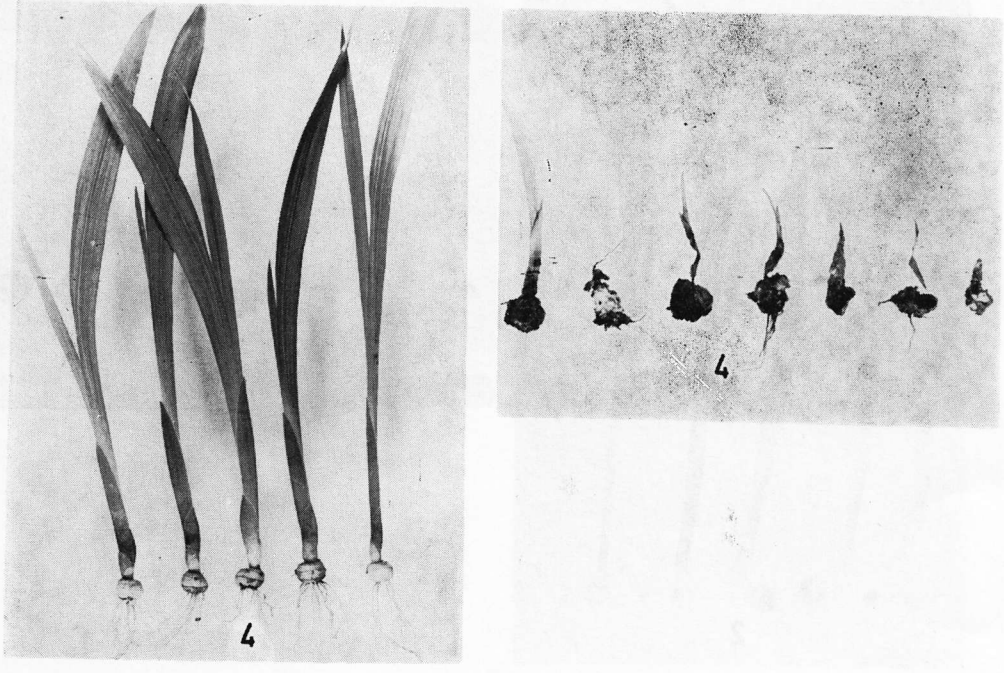

Fig.4. Infected and control gladioli plants of Novalux variety (Control in left, diseased in right).

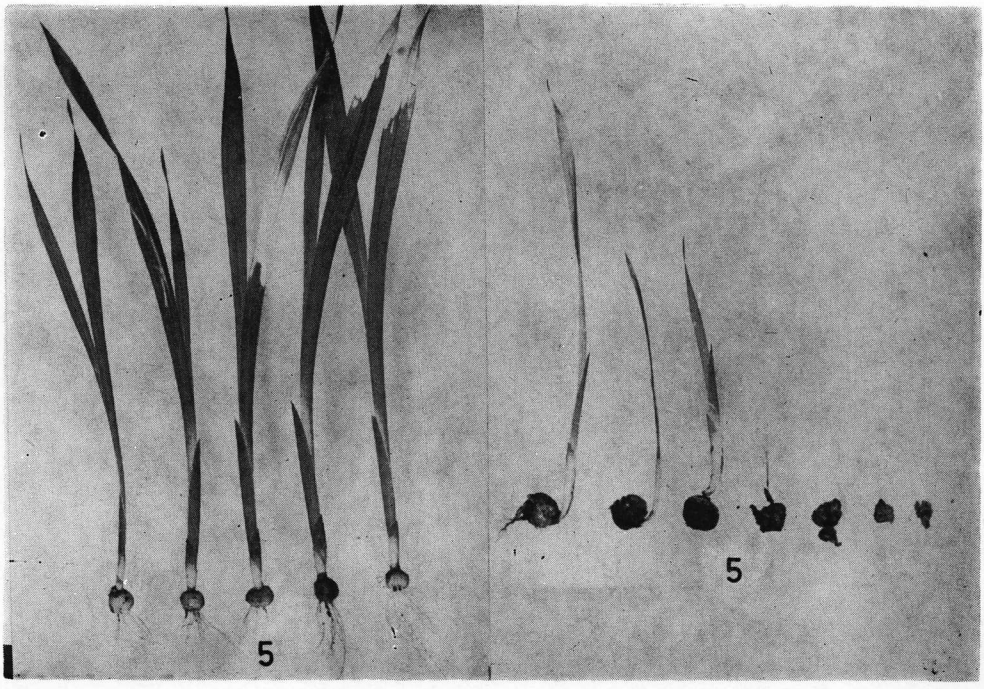

Fig.5. Infected and control gladioli plants of Victor borge variety (Control in left, diseased in right).

J. Turkish Phytopath., Vol.: 12, No. 2-3, 77-82, 1983.

Transmission of Seed-borne Infections of **Ascochyta rabiei** (Pass.) Labr. to Seedlings and Its Control

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ABSTRACT

Transmission of **Ascochyta rabiei** to the aerial parts of seedlings of chickpea by naturally infected seeds was 25 % in greenhouse and 12.2 % in the field contidions. Seed treatment with thiram (80 % W.P.) plus Benomyl (50 % W.P.) (1 : mix.) at 6 g product/kg seed preventted transmission of the disease and increased emergence by reducing damping-off. Benomyl and Thiabendazole alone greatly reduced the incidence of **A. rabiei** by seed transmission but emergence was low in the field conditions.

INTRODUCTION

Chickpea **(Cicer arietinum)** is one of the most extensively grown legume crops in Turkey. Blight of chickpea caused by **Ascochyta rabiei** (Pass.) Labr. is a serious and important disease in this country (BREMER, 1948; KARAHAN, 1968; MADEN et al., 1975; ESER and SORAN 1978). Seed transmission plays the main role in survival of the disease in areas where environmental conditions are favorable for disease epidemics (KARAHAN, 1968; HALFON-MEIRI, 1970; KAISER, 1973; MADEN et al., 1975). Very good control of the disease by treating seeds with Benlate and Thiabendazole was achieved (KAISER et al., 1973) but in the practice seed treatment should also control root-rot fungi (COTHER, 1971) and naturally infected seeds be used. To evaluate the fungicides seed transmission of the disease to seedlings should also be known since there is very little information on this aspect (MADEN et al., 1975).

This study was carried out to observe the seed transmission of **A. rabiei** to seedlings and the control of seedborne infections by treating naturally infected chickpea seeds with different fungicides which were found effective by other workers.

MATERIALS and METHODS

In this study, deeply-infected seeds were used. The seeds which had typical **A. rabiei** lesions were selected from the seed samples brought all over Turkey.

For transmission of the disease

130 seeds were taken randomly, then 100 seeds were classified based on the position of lesions of **A. rabiei.** A seed was considered to have four surfaces, being the upper surface, the bottom surface from where rootlets emerge, and the two sides. The upper portion infected seeds were counted and the conformity of the numbers found to the expected ratio, that is 1/4 or 25 %, was checked statistically bythe CHI-SQUARE TEST. The remaining thirty seeds were sown in the pots in greenhouse and seedlings showing **A. rabiei** symptoms on the aerial parts were established. Their fitness to the expected ratio was also checked.

For the control of seed infections of **A. rabiei** the following funficides in different forms of applications were used:

1) bis (dimethylthiocarbamoyl) disulfide (thiram, 80 % W.P.)
2) methyl 1- (buthylcarbamoyl) 2- benzimidazolecarbamate (benomyl, 50 % W.P.)
3) 2- (4- thiazolyl) - benzimidazole (thiabendazole 50 % W.P.)

In addition of seed dusting of each fungicides, thiram soaking (seeds were soaked in 0.2 % suspension for 24 hours at 20°C), and thiram plus benlate mixture on a 1:1 mixture were used.

Evaluation of the effectiveness of the fungicides was made by incubating seeds on Blotter Method and by sowing the seeds in pots in greenhouse and in the field. On Blotter method, 20 seeds (5 seed in a 10 cm diametre petri dish) with three replicates were used. Counts were made after 10 days of incubation in darkness at 20°C by cutting seeds from the infected portions and making observations by a stereo-microscope for fungal development. In case of doubt, re-inoculations were made. In the greenhouse 10 seeds were sown in a pot of 20 cm diametre with three replicates. After four weeks seedlings were taken out, washed off and infected ones including root infections were counted. In the field, 40 seeds with 5 replicates were sown. At the same time vacuum inoculated seeds with **A. rabiei** as KAISER (1973) were also used. This time 150 seeds in a parcel with 4 replicates were used.

RESULTS and DISCUSSION

Location of A. rabiei lesions on the seed.

The number of the seeds which had infections on upper portions (Figure 1) are given in Table 1, with the expected and found ratios. The ratio of upper portion infection was 1/4 or 25 %.

Table 1. Fitness of the numbers of upper portion infected seeds to the expected 25 % raio in 100 seeds.

Classes	Observed (x)	Expected (m)	Difference (x—m)	$((x-m)-0.5)^2/m$
Upper portion infected seeds	31	25	+6	$(6-0.5)^2/25=1.21$
The other sides infections	69	75	—6	$(-6-0.5)^2/75=1.56$
	$x^2(5\%)=3.841$			$x^2=1.77$

This result shows that location seeds of chickpea occurs randomly.

Transmission of A. rabiei to seedlings

The number of seedlings having infection on the aerial parts out of 30 seeds sown in pots in greenhouse after three weeks are given of the infection of **A. rabiei** on in Table 2. The percentage of transmission of **A. rabiei** to seedlings was 25. In the field, out of 200 deeply infected seeds, the ratio of emergence was 65.5 % while the diseased ones which had infections on the aerial parts were 12.2 %.

Table 2. The ratio of transmission of **A. rabiei** to seedlings from the infected seeds (30 seeds).

Classes	Observed (x)	Expected (m)	Difference (x—m)	x^2 $((x-m)-0.5)^2/m$
Seedlings having aerial infection	5	7.5	—2.5	1.16
Healthy looking seedlings	24	22.5	1.5	0.04
	$x^2(5\%)=3.841$			$x^2=1.20$

The ratio of transmission of **A. rabiei** from infected seeds to seedlings was not high. This ratio of 25 % was identical with the percentage of upper portion infected seeds in the greenhouse but it decreased in the field conditions. There is no doubt that climatic conditions could effect germination and consequently transmission of the disease but in any case this ratio could be about 10 % of the infected seeds because the field conditions were very favorable for germination.

Effects of seed treatment fungicides on A. rabiei

The effectiveness of the fungicides to seed-borne infections of **A. rabiei** on Blotter Method and in greenhouse are shown in Tables 3 and 4 respectivelly. As seen from the tables thiram dust and soak were not sufficiently effective so they were omitted in the field applications.

Table 3. Effect of seed-treatment fungicides on deep-seated natural infections of **A. rabiei** on Blotter Test.+

Fungicides	Rate of application g/kg seed	% Diseased	% Effectiveness	Different groups
Thiram susp.	2 (g/lt water)	8.0	88.8	c
Thiram dust	3	50.0	30.0	b
Benomyl	3	5.0	93.0	c
Thiabendazole	3	3.0	95.8	c
Benomyl + Thiram	3+3	1.5	97.9	c
Control		71.5		a

+ Results are the averages of three replications of 20 seeds.
a, b, c Different groups according to Duncan Test.

Table 4. Effect of seed treatment fungicides on deep-seated infections of A. rabiei in pots in greenhouse.+

Fungicides	% Diseased	% Effectiveness	Different groups
Thiram Susp.	46.6	12.6	a
Thiram Dust	50.0	6.1	a
Benomyl	3.0	93.8	b
Thiabendazole	0.0	100.0	b
Benomyl + Thiram	0.0	100.0	b
Control	53.0		a

+ Average of three replications of 10 seed/pot

The effective fungicides on Blotter Method and pot experiments; Benomyl, Thiabendazole and Benomyl + Thiram, were tested in the field by using vacuum inoculated seeds by **A. rabiei.** This time along with **A. rabiei**, pre and post emergence diseases of chickpea were also determined. The results are shown in Table 5.

Table 5. Effectiveness of seed-treatment fungicides on **A. rabiei**[a] and emergence of chickpea.

Fungicides	% Emergence[b]	% Diseased[c]
Benomyl	69.3	0.0
Thiabendazole	52.5	0.0
Benomyl + Thiram	90.1	0.0
Control	32.6	57.2

a) Vacuum inoculated seeds of **A. rabiei** were used

b) Results are averages of 4 replicates, 150 seed/repl.

c) Counts were made during pod set.

As shown in Table 5, Benomyl and Thiabendazole treated plots yielded low emergence compared to Benomyl + Thiram treatment. Is these plots post-emergence damping-off, caused by mostly **Rhizoctonia solani** and **Pythium** sp., was observed and the growth of the plants were also weak.

In the field, naturally infected seeds by **A. rabiei** were treated by only Benomyl + Thiram. This time emergence was 80 % in treated plots, while it was 65.5 % in controls There were not any diseased plants in the treated plots during vegetation of chickpea but in the controls average disease was 12.2 % after three weeks from the sowing and it reached to 100 % in the end of the season.

Effective control of seed-borne inoculum of **A. rabiei**, which is very much important for disease epidemics (HALFON-MEIRI, 1970; KAISER, 1973; MADEN et al., 1975) could prevent its spread and damage. The seed treatment fungicides such as Benomyl and Thiabendazole were found highly effective (KAISER et al., 1973) but their use alone did not improve germination because of the other root-rot pathogens. Combination of Thiram with Benomyl as stated by COTHER (1977) did not only prevent seed-borne **A. rabiei** but improved the rate of germination. But the rates of seed-treatment fungicides in this experiment were lower than given by COTHER (1977) and still

effective. The reason for relatively low germination of infected seeds in the field conditions, that was 80 %, may be the destruction of shoot primordia by the pathogen before treatment.

Ö Z E T

NOHUT ANTRAKNOZUNDA TOHUM ENFEKSİYONLARININ FİDELERE TAŞINMASI VE TOHUM İLAÇLARI İLE BU TAŞINMANIN ÖNLENMESİ

Doğal olarak **Ascochyta rabiei** ile enfekte edilmiş nohut tohumlarından hastalık fidelerin toprak üstü kısımlarına serada % 25, tarlada % 12.2 oranında taşınmıştır. Thiram+Benomyl (1 : 1 karışım) 6 g ilaç/kg tohum hastalığın tohumdan geçişini önlemiş ve kök çürüklüğünü azaltarak çıkışı arttırmıştır. Benomyl ve Thiabendazole tek başlarına **A. rabiei**'nin tohumla taşınan enfeksiyonunu yüksek oranda önlemişler fakat tarla koşullarında çıkış düşük bulunmuştur.

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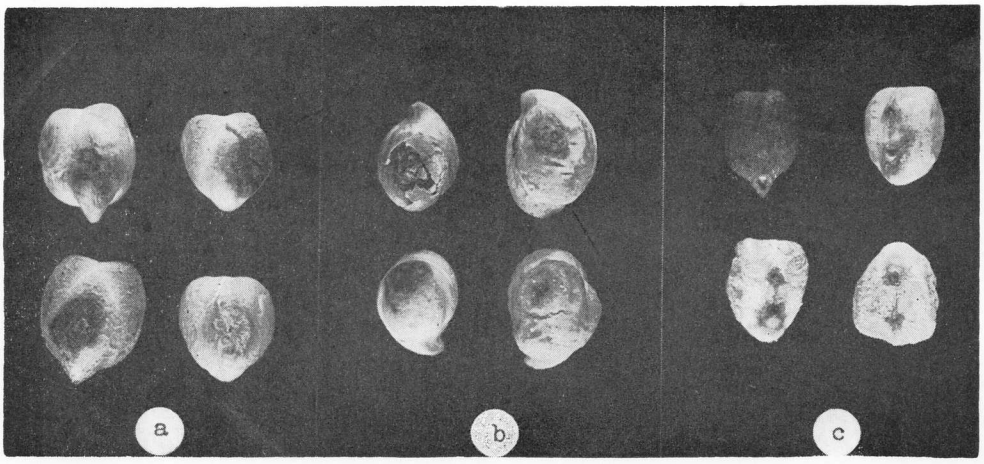

Figure 1. Chickpea seeds infected with **Ascochyta rabiei** showing lesions a) on the upper portions b) on the sides c) on the lower portions of the seeds.

J. Turkish Phytopath., Vol. 12, No. 2-3, 83-101, 1983.

A Strain of Tobacco Mosaic Virus (TMV) Affecting Pepper Plants

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ABSTRACT

A virus disease of pepper was found in locally grown pepper cultivars showing wilting, stunting, necrosis on stems, defoliation, mosaic and leaf and fruit deformation. The virus caused similar symtoms to common Tobacco mosaic virus (TMV) on some test plants used in this study. However, the virus isolated from peppers probably differed from some known strains of TMV because it failed to infect **Nicotiana glauca** Graham., it induced latent infection on **Lycopersicon esculentum** Mill. and it produced chlorotic local lesions on **Gomphrena globosa** L., necrotic local lesions on some cultivars of **Phaseolus vulgaris** L. and both local and systemic symptoms on **Petunia hybrida** Hort., Physical properties of the virus were: dilution-ens point, 10^{-7} to 10^{-8}; thermal inactivation point, 90-95°C and longevity **in vitro**, over 60 days at 20+2°C. A distant serological relationship was detected between the virus from peppers and TMV (tobacco and tomato strains), but not between it and Potato virus X and Potaso virus Y. Electron micrographs of sap from plants infected with virus on peppers showed that virus particle was a straight-rod, 300x15 nm. Evidence obtained from studies on host range, physical properties, serology and electron microscopy indicates that virus isolated from peppers is a strain of TMV.

1 INTRODUCTION

Pepper (**Capsicum annuum** L.) is extensively grown in the region of Ege over an area of about 5.199 ha being one of the most common horticultural crops (4). In recent years, the cultivation of pepper in both fields and glasshouses has been considerably increased. However, pepper is known to be very susceptible to virus infections .In some studies performed in Turkey (2, 12, 26, 31) it was found that most of the pepper plantings in some localities were affected by viruses such as Cucumber mosaic virus (CMV), Potato virus X(PVX), Potato virus Y(PVY) and Tobacco mosaic virus (TMV), but in those works the identification of these viruses had been based only on symptom expression of some test plants.

During the past two growing seasons, the symptoms of a wides-

pread virus disease has been observed on the pepper plants, the seeds of which had been obtained from several Institutions in Turkey, in our glasshouse research stock and on those cultivated especially under the glasshouse conditions in some locations of Izmir in Ege. The primary symptom of disease in question was the sudden wilting of some branches of plants which were at the stage of flowering or setting fruits. The secondary symptom was necrosis appearing on the main stem and some branches of the diseased plants, from tip to base. In certain cases, colour deviations and later, necrosis was observed on the fruits. The leaves of diseased plants exhibited a mild mosaic at the beginning and then, most of them were defoliated. Within about 3 to 6 weeks, the affected plants either died or dried out. In consequence of the preliminary studies performed by us, the causal agent was proved to be TMV.

This paper reports some information as to the symptoms on certain test plants, physical properties, serological relationships and electron microscopy of TMV isolated from pepper plants.

2 MATERIAL and METHODS

2.1 Virus source and inoculation

The virus isolate used in this study was obtained from the infected pepper cultivars «Çarliston» (a type of conical shaped pepper) and «Dolmalık» (bell pepper) grown in our research glasshouse and in some locations of Izmir. The virus under study was maintained in **Nicotiana tabacum** L cv. Maden test plants. Inoculum was prepared from the young leaves of the these plants systemically infected with virus for 20-24 days, and the resulting sap was diluted to 1 : 5 with 0,02 M phosphate buffer (pH 7,2). Test plants, shown in Table 1, were mechanically inoculated by rubbing the celite-dusted leaves by means of cotton swabs dipped in the freshly prepared inoculum. After inoculation, the leaves of test plants were rinsed with tap water and the plants placed into a room at 22 ± 2°C with 16 h/day of supplementary artificial illumination (6.000 lux). The test plants were observed for at least 30 days after inoculation for symptom development and those not showing any symptoms were reinoculated. In the host reaction studies, four or more young plants of each species were inoculated with the virus from peppers. Recovery tests were applied to **Nicotiana glutinosa** L. test plants from the inoculated or young leaves of the host plants considering local or systemic infection.

2.2 Tests of physical properties

To determine the physical properties of the virus isolate such as dilution-end point (DIP), the thermal inactivation point (TIP) and longevity **in vitro** (LIV) at 20 ± 2°C, **N. tabacum** cv. Maden infected

with this virus was utilized as the source plant and **N. glutinosa** as the assay plant.

2.3 Purification

The virus was purified from **N. tabacum** cv. Maden leaves harvested 3-4 weeks after inoculation in copliance with the procedure of Gooding and Habert (10).

2.4 Ultraviolet absorption spectrum

The ultraviolet absorbtion spectra of the virus between 230 and 330 nm were determined with a PYE Unicam SP 8-100 UV-VIS spectrophotometer. For measurements, the well-purified virus preparations were used.

2.5 Serology

In serological assays, the agar-gel double diffusion test was employed as described by ouchterlony (25). Tests were performed in petri plates of 1 % bacto agar dissolved in 0,01 M Tris buffer (pH 8,0 to which both 0,9 % NaCl and 0,02 % sodium azide had been added. Antisera dilutions were made in saline. Following the addition of antigen and antisera, plates were incubated at the room temperature for 2 or 3 days.

2.6 Electron microscopy

For the electron microscopic observations, the partially purified crude leaf extracts of the systemically infected plants were negatively stained in 1 % Na-phosphotungstate (pH 6,5) according to Hitchborn and Hills (13) and examined in a JEOL JEM-100 C electron microscope. Virus particles were measured on the enlarged prints of negatively stained grids according to Brandes (1).

3 RESULTS

3.1 Host reactions

The development of virus infection in the inoculated hosts are summarized in Table 1.

The data in Table 1 indicate that **B. vulgaris, C. amaranticolor, C. quinoa, D. stramonim, G. globosa, N. glutinosa, N. tabacum** cv. Samsun NN and cv. Xanthi-nc, and **P. vulgaris** cv. Pinto and cv. Yalova 5 showed local lesions on the inoculated leaves (Fig.1 and Fig.2). As it is seen in Table 1, the virus caused systemic infection on **N. tabacum** cv. Maden and **P. floridana** plants (Fig.2e).

Initially, **P. hybrida** plants developed chlorotic local lesions (Fig.2b) which later became necrotic 7 to 8 days after inoculation, then these symptoms were followed by mosaic and deformation on young leaves. **L. esculentum** plants produced no symptoms in general, but very slight mosaic was noticed on a single plant when they were inoculated with virus under study.

The virus from peppers did not induce any symptoms on ,and could not be recovered from, inoculated or

new leaves of the following plants: **C. melo, C. sativus, N. glauca, P. vulgaris** cv. Red Kidney, **V. faba** cv. Sakız and **V. unguiculata** cv. Black Eye.

On the inoculated leaves of **C. annuum** cv. Çarliston plants, the virus first produced irregular chlorotic patches 3 to 6 days after inoculation (Fig.3a). These were followed by defoliation of the inoculated leaves and pronounced mosaic on young leaves (Fig.3c,d). In some cases, the virus caused wilting and the ultimate death of young plants within a week or so (Fig.3e). Later, the plants survived considerably stunted and showed necrotic streaks on stems (Fig.4a). The virus brought about leaf and fruit deformation (Fig.4b), and necrosis on fruit stalks and fruits of pepper plants which had been infected 8 to 10 weeks before (Fig.4c,d). Finally, the effected pepper plants wilted and dried out.

The virus produced necrotic spots on the inoculated leaves of **C. annuum** cv. Dolmalık plants (Fig.3b). Although, at the beginning, necrotic spots were small and brown, then, they became larger, gray inside and surrounded

Table 1. Symptoms caused by the virus isolated from pepper plants on certain test plants

Test Plant	Symptoms[x]	
	Local	Systemic
Beta vulgaris L.	CSp 7-9 days after inoculation-V	O-Va
Capsicum annuum L. cv. Çarliston	CSp or CM 3-6 days after inoculation-V	LeDis, LeAb, M, Stu, Y, StN, FDis, FNStr, Wi-V
C. annuum L. cv. Dolmalık	BrNSpPc 5-7 days after inoculation-V	LeAb, Y, SM, Stu, StN, LeDis, FDis-V
Chenopodium quinoa Willd.	NSp 5-7 days after inoculation, LeDis-V	O-Va
C. amaranticolor Coste and Reyn.	BrNSpPc 7-8 days after inoculation, LeAb-V	O-Va
Cucumis melo L.	O-Va	O-Va
C. sativus L.	O-Va	O-Va
Datura stramonium L.	BrNSpPc 4-7 days after inoculation, LeAb-V	O-Va
Gomphrena globosa L.	CSp 5-7 days after inoculation, LeAb-V	O-Va
Lycopersicon esculentum Mill. cv. Roma	O-V	Ma or SM-V
Nicotiana glauca Graham	O-Va	O-Va
N. glutinosa L.	BrNSp 3-4 days after inoculation, LeDis-V	O-Va
N. tabacum L. cv. Maden	DifCsp 5-6 days after inoculation-V	LeDis, LePu, GM-V
N. tabacum L. cv. Samsun NN	BrNSp 3-5 days after inoculation-V	O-Va

(continued on next page)

Table 1. (continued)

Test Plant	Symptoms[x]	
	Local	Systemic
Nicotiana tabacum L. cv. Xanthi-nc	BrNSp 2-4 days after inoculation, LeAb-V	O-Va
Petunia hybrida Hort.	CSp 7-8 days after inoculation-V	CM, YoLeDis-V
Phaseolus vulgaris L. cv. Pinto	BrNSp 4-7 days after inoculation-V	O-Va
P. vulgaris L. cv. Yalova 5	BrNSp 4-7 days after inoculation-V	O-Va
P. vulgaris L. cv. Red Kdney	O-Va	O-Va
Physalis floridana Rydb.	O-V	CM, LeAb-V
Vicia faba L. cv. Sakız	O-Va	O-Va
Vigna unguiculata L. Walp. cv. Black Eye	O-Va	O-Va

[x] Abbreviations used in Table

Ab	abscission	M	mosaic or mottle	St	stem
Br	brown	Ma	masking	Str	streak
C	chlorotic	N	necrosis or necrotic	Stu	stunting
Dif	diffuse	O	no manifestation of disease	V	virus revoverable
Dis	distortion	Pc	pale center	Va	virus absent
F	fruit or fruits	Pu	puckered	Wi	wilting
G	green	S	slight	Y	yellowing
Le	leaf or leaves	Sp	spots	Yo	young

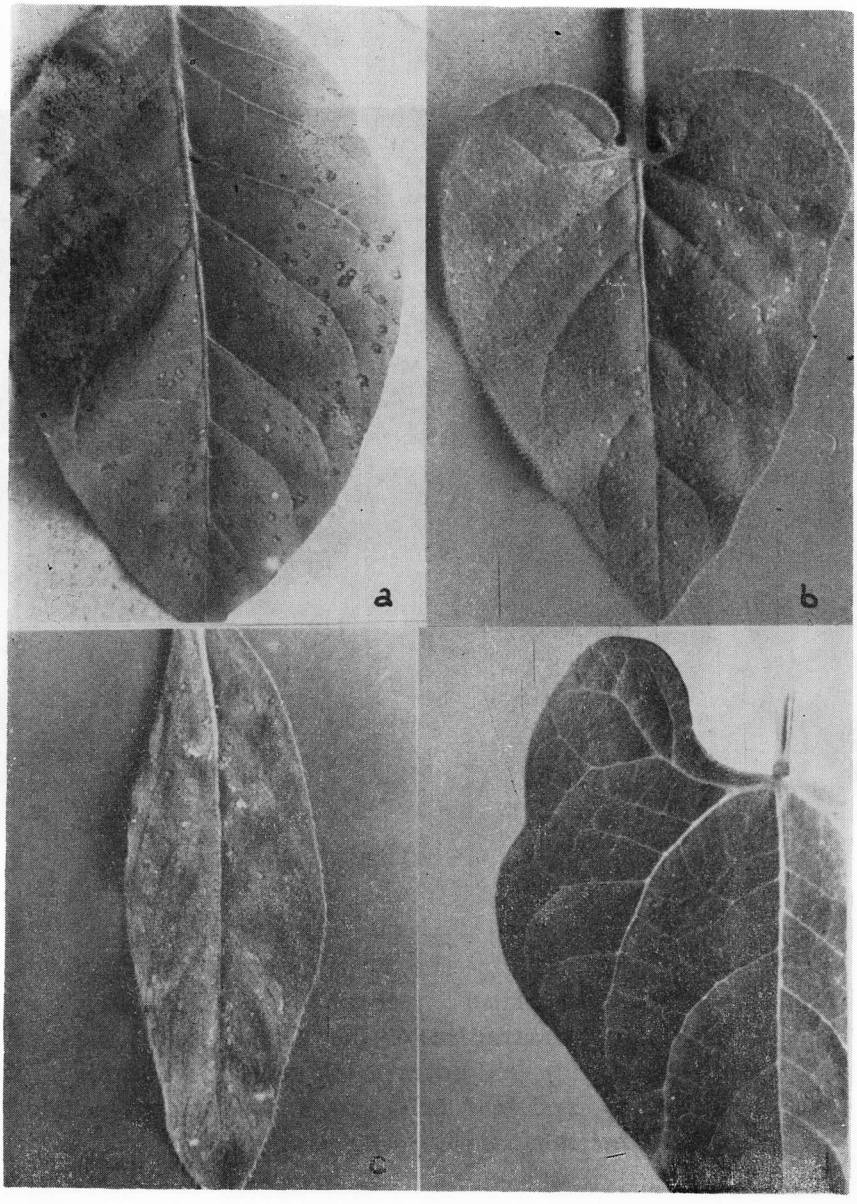

Fig.1. Symptoms caused by the virus isolated from peppers in various test plants: necrotic local lesions in **Nicotiana tabacum** cv. «Xanthi-nc» (a), **N. glutinosa** (b), **Phaseolus vulgaris** cv. «Pinto» (d) and chlorotic local lesions in **Gomphrena globosa** (c).

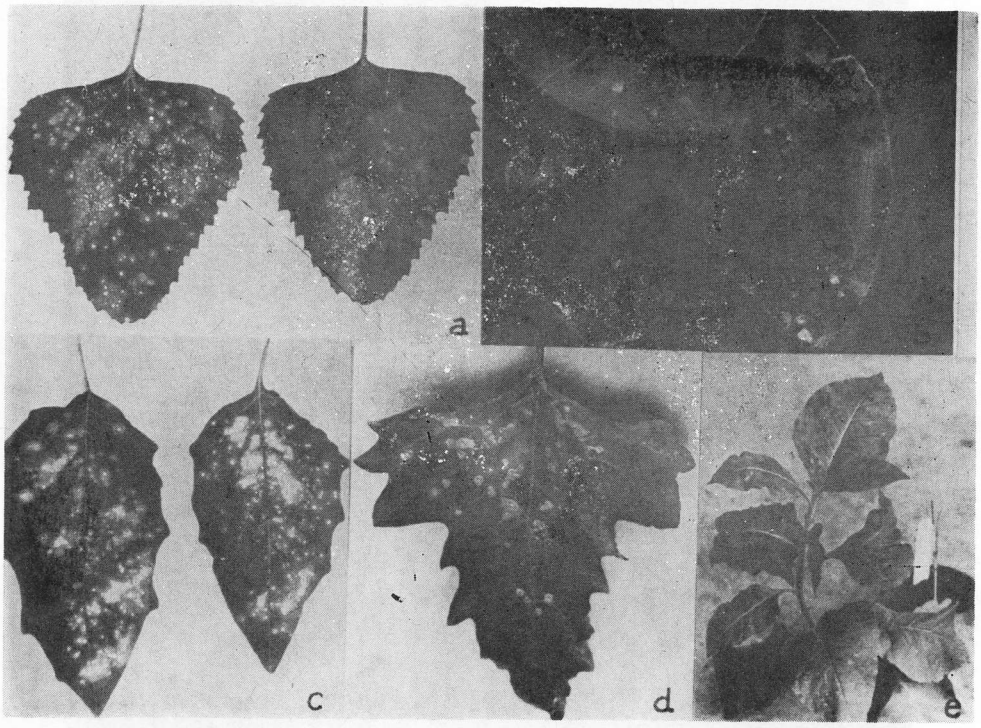

Fig.2. Symptoms caused by the virus isolated from peppers in various test plants: necrotic local lesions in **Chenopodium amaranticolor** (a), **C. quinoa** (d), **Datura stramonium** (c), chlorotic local spots in **Petunia hybrida** (b), and leaf deformation and green mosaic in **Nicotiana tabacum** cv. «Maden» (e).

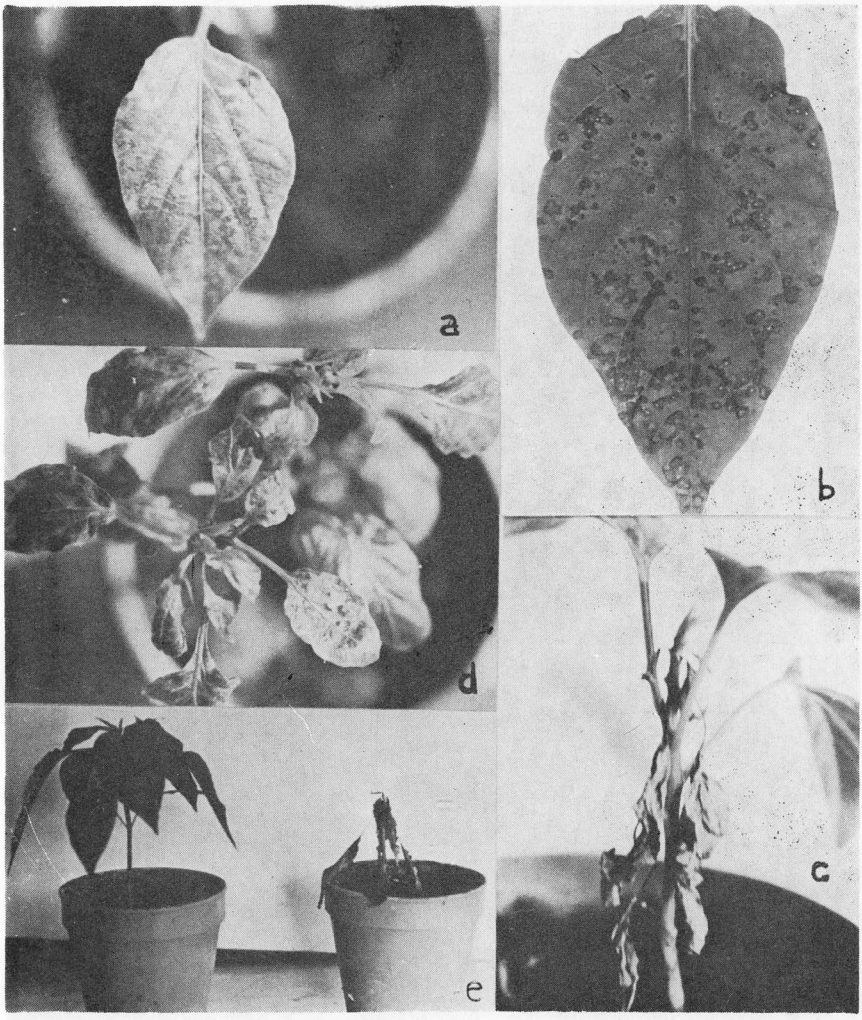

Fig.3. Symptoms of the virus isolated from peppers on **Capsicum annuum** plants:
a) Irregular chlorotic patches on the leaf of «Çarliston» cultivar, b) Necrotic spots on the leaf of «Dolmalık» cultivar, c) The defoliation of the inoculated leaves, d) The pronounced mosaic and deformation on young leaves, e) The plant showing the wilt and stunting symptoms (right) about a week after inoculation and the healthy, uninoculated control plant (left).

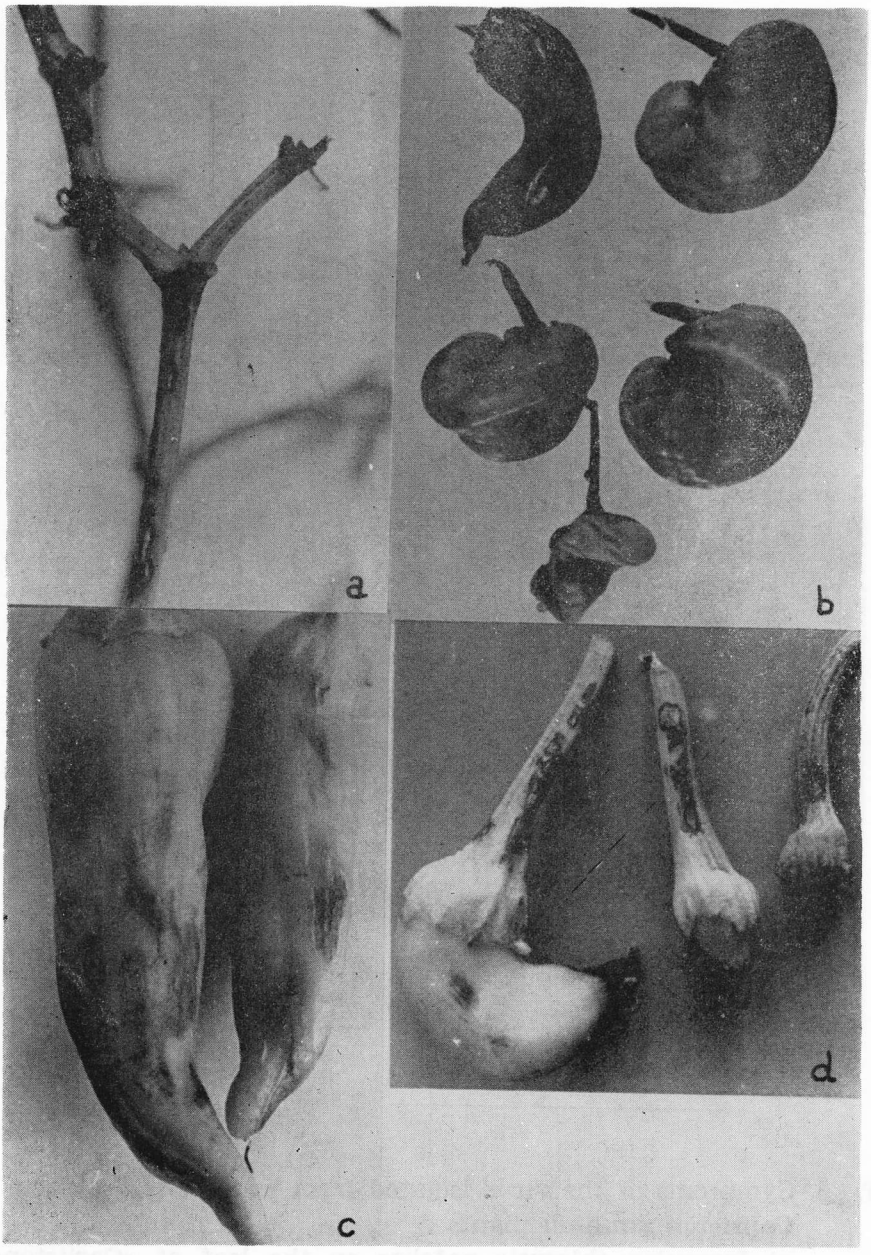

Fig.4. Symptoms of the virus isolated from peppers on **Capsicum annuum** plants:
a) Necrotic streaks on stem,
b) The deformation of fruits,
c) Necrosis of the fruits,
d) Necrosis on the fruit stalks.

by a dark zone. Necrotic spots were not present on upper young leaves of pepper plants. Later, the symptoms observed were yellowing and dropping leaves. These were followed by a slight mosaic on young leaves and necrotic streaks on stems. The virus cuased leaf and fruit deformation and, rarely, necrosis on fruit stalks and fruits of the affected plants.

3.2 Physical properties

The physical properties of virus isolate determined by the infectivity tests on **N. glutinosa**. The results obtained in these tests are presented in Table 2.

According to the figures in Table 2, the virus was still infective at the dilution of 10^{-7}, but not at 10^{-8} and beyond; the thermal inactivation point of the virus was between 90 and 95°C, and the virus could be recovered from crude sap stored for more than 60 days at 20+2°C.

Table 2. The physical properties of virus isolated from pepper plants

Dilution		%	Heating (°C)		%	Storing **in vitro**x		%
Undiluted	370,8xx	100,00	Unheated	178,8xx	100,00	Unstored	273,9xx	100,00
10^{-1}	282,7	76,24	70	107,7	60,23	1 days	197,1	71,96
10^{-2}	197,6	53,29	80	77,4	43,28	2 days	181,3	66,19
10^{-3}	68,0	18,34	85	22,3	12,47	7 days	175,5	64,07
10^{-4}	31,4	8,47	90	2,8	1,56	14 days	103,7	37,86
10^{-5}	10,0	2,70	95	0,9	0,50	30 days	86,2	31,47
10^{-6}	4,7	1,27				60 days	62,3	22,71
10^{-7}	2,0	0,54						
10^{-8}	0,8	0,21						

x The undiluted sap of the infected N. tabacum cv. Maden plant was stored in stoppered vials at room temperature.

xx Figures indicate the average of number of local desions obtained from 10 replications.

3.3 Ultraviolet absorption spectrum

In the consequence of the measurements in the spectrophotometer, it was found that the approximate virus yield of the purified preparation, based on an extiction coefficient $E^{0,1\ \%}_{1\ cm,\ 260\ nm}$ of 3,1 (24), was 1,275 as mg virus per of starting material. The ultraviolet absorption spectrum of the virus from peppers is presented in Fig.5 The 260/280 absorption ratio was found to be 1,222 and this ratio was similar to that recorded by Zaitlin (36) for common TMV.

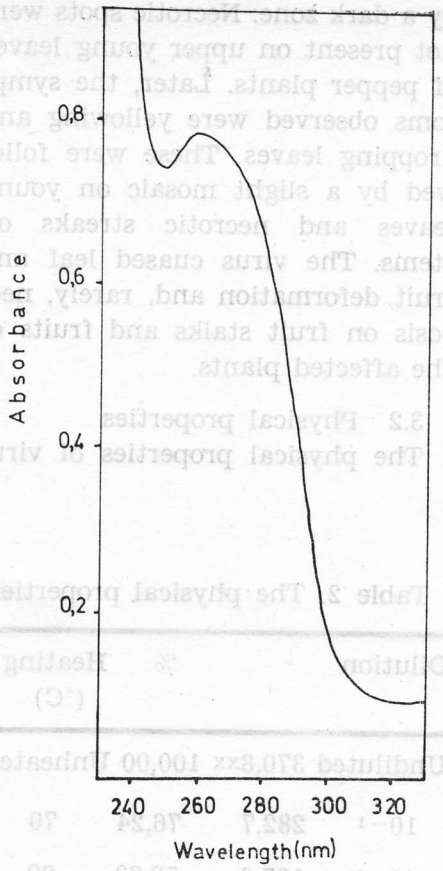

Fig.5. Ultraviolet absorption spectrum of the virus isolated from peppers.

3.4 Serological relationships

When the central well was filled with the purified preparation of virus isolated from peppers as antigen and the antisera to TMV (tobacco strain), TMV (tomato strain), PVX (strain 3), and PVY (necrotic strain) were placed into the peripheral wells, the virus gave strong positive reactions with the antisera to both strains of TMV whereas it failed to react with the antisera to PVX and PVY (Fig.6).

The clear precipitation lines were observed when the present virus isolate from peppers was individually tested with antisera to both TMV (tobacco strain) and TMV (tomato strain) (Fig.7).

From these results obtained, it can be easily seen that there is a close serological relationship between the virus on peppers, and both strains of TMV employed in serological tests.

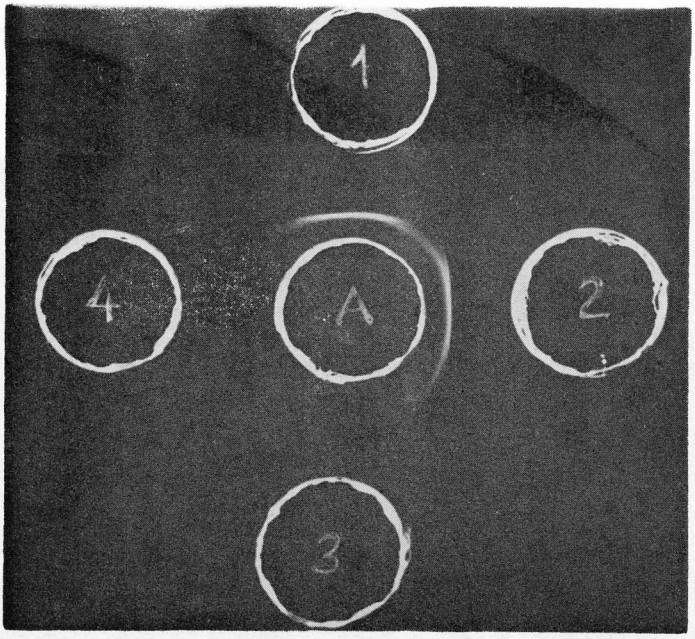

Fig.6. Serological reactions in agar gel diffusion tests
A:The purified preparation of the virus from peppers
1:TMV «tobacco strain» antiserum
2:TMV «tomato strain» antiserum
3:PVX «strain 3» antiserum
4:PVY «necrotic strain» antiserum

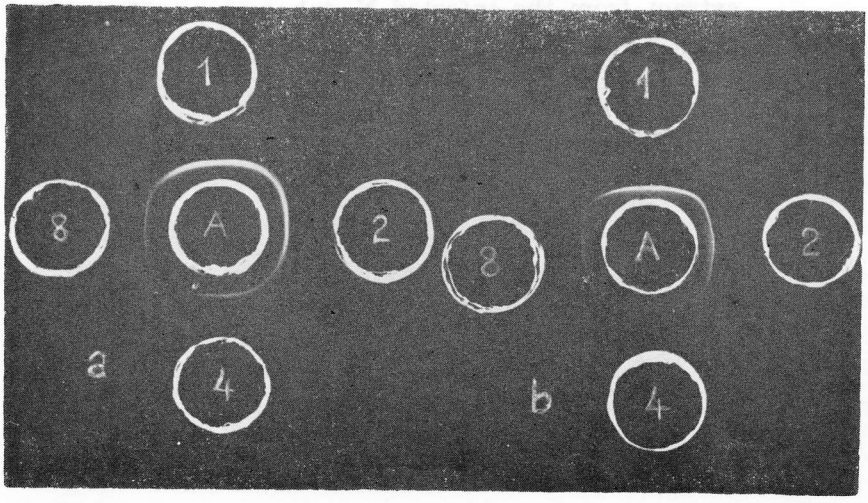

Fig.7. Diffusion tests in agar with the virus isolated from peppers and the antisera to some strains of TMV (Center wells (A) contained the purified virus from peppers. Peripheral wells were charged with the antisera to TMV-tobacco strain (a) and TMV-tomato strain (b). Numbers in Fig.7 indicate the dilutions of the antisera as 1:1/1;2:1/2;4:1/4 and 8:1/8)

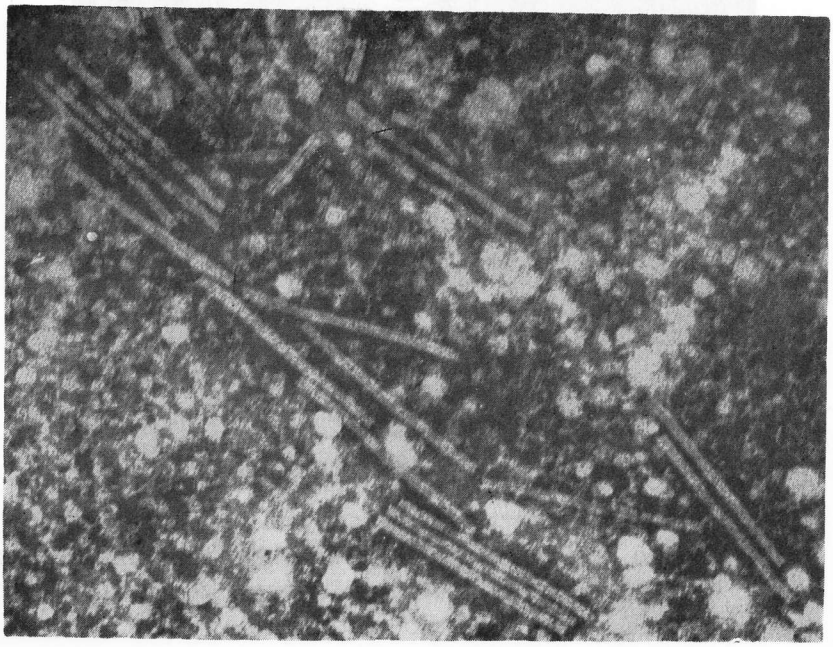

Fig.8. Electron micrograph of a negatively stained crude extract from the infected **N. tabacum** cv. Maden plant (**X** 98 500)

3.5 Electron microscopy

The electron microscopical examinations showed that the crude leaf extracts from the virus-infected plants contained numerous straight rodshaped particles, closely resembling those of common TMV (Fig.8). According to data from particle measurements, the average length of particles was 300, 92 ± 2,86 nm and the mean particle width was 15,84 ± 0,53 nm.

4 DISCUSSION

The studies based on the symptoms of certain test plants, physical properties, serological relationships and electron microscopical examinations reveal that the virus we have isolated from pepper plants seems to be a strain differing in certain features from some known strains of TMV. As it was pointed out by Jensen (16), TMV occurs in numerous strains which may differ from one another not only in host range and symptomatology, but in other ways too, such as physical properties, serological reactions and particle morphology.

TMV from peppers was found to be serologically related to tobacco and tomato strains of TMV (Fig.6 and 7). Moreover, as far as electron microscopy and the reactions of most test plants are concerned, virus under study appeared undistinguishable from TMV strains, in general (5). On the other hand, TMV isolated from peppers in the present work seems to be different from some strains of TMV considering the symptoms produced by it on certain test plants. In this study, **L. esculentum** reacted to the virus with latent infection, as reported before by Mc Kinney (19), Greenleaf et al., (11), Fribourg and Fernandez-NortNorthcote (3), and Feldman and Oremianer (5). As known, tobacco and tomato strains of TMV cause systemic symptoms on **L. esculentum** (5, 14, 15). In addition to this, it was found that **N. glauca** was immune to our virus isolate. In previous works, Holmes (14), Mc Kinney (19) and Feldman and Oremianer (5) determined that the responses of **N. glauca** to some TMV strains were as follows: systemic symptoms for common TMV, symptomless infection for tomato TMV and immune for pepper TMV. Moreover, the fact that **G. globosa** plants reacted to virus isolated from peppers with chlorotic local lesions with a reddish margin, in our opinion, may be helpful to distinguish it from some other strains of TMV which did cause any symptoms on this plant. Fribourg and Fernandez-Northcote (8), Prasada Rao and Yaraguntaiah (27) and Jasnic (15) have reported that TMV on peppers produced chlorotic local lesions on **G. globosa** as observed in our studies as well. On the contrary, according to some researchers (6, 9, 14, 15) tobacco and tomato strains of TMV induced no symptoms on the same plant. Furthermore, virus we isolated from peppers caused necrotic local lesions

on some bean cultivars used in this study, as recorded earlier (15, 27, 28, 29). However, some workers reported that the virus isolated by them from peppers produced no symptoms on bean cultivars used (18, 21, 22). According to some researchers (5, 6 ,14, 15, 20, 23). TMV from tomato do not give rise to necrotic local lesions on some bean cultivars whereas common TMV does. In our host reaction study, it was observed that virus from peppers produced initially local symptoms on the inoculated leaves of **P. hybrida** ,later mosaic on young leaves. Sugiura et al., (29) and Jasnic (15) reported that pepper TMV caused pronounced mosaic on **P.** hybrida while the pepper strains of TMV described by Mathur et al (18), Feldman and Oremianer (5) and Sandhu and Chohan (28) produced local lesions on the same host plant. The earlier works showed that TMV from tomato induced only local lesions or no symptoms (15, 20) and common TMV brought about local or systemic symptoms (14, 15) on **P. hybrida** plants.

The fact that even in some of the known local lesion hosts (especially **N. glutinosa** and **N. tabacum** cv. Xanthi-nc), our virus isolate tends to become systemic and kills the plants within 2 weeks or so is one of the most outstanding features observed in the course of our host reaction studies. Considering the results of the present study as well as other reports on the same subject, we can suggest the following plants as differential hosts to be considered useful for identifying TMV on peppers: **Capsicum annuum** (different cultivars), **Gomphrena globosa, Lycopersicon esculentum, Nicotiana glauca, N. glutinosa, N. tabacum** cv. Samsun and Xanthi-nc, **Phaseolus vulgaris** cv. Pinto and other. Of course, it is a minimum list, and some other plant species according to the provenance of the virus isolate involved should be added to this list.

The physical properties (DEP, TIP and LIV) of the virus in the present study were a little bit more than those recorded for tomato TMV, but almost identical with those for common TMV in literature (7, 9, 15, 17). The data on DEP, TIP and LIV in this study (Ta.2) agree with those determined before by some workers (8, 18, 19, 21, 28, 29, 30, 33), fo rTMV on peppers. Investigations performed have shown that TMV can be transmitted via pepper seed from one generation to the next (3 19, 32, 34, 35). The seed transmission of TMV on peppers is significant because the small amount of seed-borne virus would be ample primary inoculum to cause serious losses in the field. Since symptoms of this virus on peppers appear at the flowering stage or at the beginning of fruit maturity, it is not possible to see the diseased plants and eliminate them during earlier growing stages. This feature makes possible the maintaining and spreading of TMV through pepper seeds as indi-

cated by Tosic et al (32). Apart from this, the fact that all of the plants infected with this virus exhibit no visible symptoms and, so, seed for the commercial purpose can be taken from the diseased plants, too, shows that pepper seed is of a great importance in the epidemiology of TMV.

ACKNOWLEDGEMENTS

The authors would like to give the thanks especially to Doç. Dr. Mehmet YILDIZ for his interest and advices and to Erol GÜÇ for his kind help as to the perusal of the manuscript.

Ö Z E T

BİBERLERDE HASTALIK YAPAN TÜTÜN MOZAYIK VİRUSU (TMV) IRKI

Yöremizde yetiştirilen biberlerde solgunluk, bodurlaşma bitki sapları üzerinde nekroz, yaprakların dökülmesi, mozayık ile yaprak ve meyvelerde şekil bozuklukları gibi belirtiler oluşturan bir virus hastalığı bulunmuştur. Söz konusu virus, bu çalışmada kullanılan bazı test bitkilerinde Tütün Mozayık Virusu (TMV)'nun belirtilerine benzer simptomlar meydana getirmiştir. Bununla beraber; biberlerden izole edilen virusun **Nicotiana glauca** Graham.'da belirti oluşturamaması, **Lycopersicon esculentum** Mill.' da gizli infeksiyon yapması, **Gomphrena globosa** L.'da klorotik lokal leke, bazı **Phaseolus vulgaris** L. çeşitlerinde nekrotik lokal leke ve **Petunia hybrida** Hort.'da hem lokal ve hem de sistemik simptom oluşturması, bu virusun TMV'nun bilinen bazı ırklarından muhtemelen farklı olduğunu göstermiştir. Virusun, son seyreltme noktasının 10^{-7} ile 10^{-8} ve sıcaklıkla inaktifleşme noktasının 90 ile 95°C arasında olduğu ve **in vitro** da 20 ± 2°C de 60 günden fazla süre ile aktif kaldığı bulunmuştur. Biberlerde görülen virusun TMV'nun domates ve tütün ırkları ile serolojik olarak akraba olduğu saptanıldığı halde, bu virus ile patates X ve Y virusları arasında aynı tür bir ilişkinin olmadığı gözlenmiştir. Elektron mikroskopta yapılan çalışmalar, biberlerdeki virusun, çubuk şeklinde ve 300x15 nm. boyutunda partiküllere sahip olduğunu ortaya koymuştur. Konukçu dizisi, fiziksel özellikler, seroloji ve elektron mikroskop ile ilgili çalışmalardan elde edilen bulgular, biberlerde görülen virusun TMV'nun bir ırkı olduğunu göstermektedir.

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J. Turkish Phytopath., Vol. 12, No. 2-3, 103-111, 1983.

Effect of Heat Treatment of Infected Seeds and Granular Application of Insecticide on Field Spread of Cowpea Banding Mosaic and Seed Yield of Cowpea

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ABSTRACT

Dry heat treatment of cowpea seeds infected with Cowpea banding mosaic virus (CpBMV) at 65°C for 15 minutes followed by incubation at 30°C for 4 days reduced the seed transmission from 13.13 - 24.7 % to 0.9 - 3.33 % and seed germination from 85.0 - 91.13 % to 61.37 - 71.44 %. Heat therapy of seeds also reduced the field spread of CpBMV to 4.79 - 9.17 % as compared to 23.72 - 29.74 % in control. Seed yield from heat treated seeds was 19.3 - 22.4 % higher than untreated diseased seeds. Heat therapy of infected seeds coupled with side application (treatment) of disulfoton granules resulted in significant increase in plant height, seed yield and decrease in field spread of CpBMV.

INTRODUCTION

Cowpea (**Vigna unguiculata** (L.) Walp.) is attacked by a large number of virus and virus-like diseases. Cowpea banding mosaic (CpBMV), a member of Cucumovirus group, is the most common virus disease in India and is seed-borne to an alarmingly high degree in the seeds of cowpea (Sharma and Varma, 1975 a, b). Seven different aphid species have been reported as vectors for the virus and **Aphis craccivora** Koch. as the most efficient vector (Sharma and Varma, 1982 a). Several viruses have been successfully inactivated from the planting material of vegetatively propagated plants (Nyland and Goheen, 1969) but very few from the true seeds. Bean mosaic, cowpea banding mosaic, cowpea (Chavali) mosaic, cucumber green mottle mosaic, necrotic ring spot and prune dwarf, tobacco mosaic, uridbean leaf crinkle and vegetable marrow mosaic viruses were eliminated from the seeds of bean, cowpea, cucumber, **Prunus** spp., tomato, sweet pepper ,uridbean and vegetable marrow, by heat therapy (Berkmortel, 1977; Broadbent, 1965; Fletcher et al. 1969; Howles, 1961; Kadian,

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1981; Megahed and Moore, 1969; Sharma and Varma 1975b; Sharma and Chohan, 1971; Verma, 1971). Fletcher et al. (1969) found heat therapy better than chemotherapy for cucumber green mottle mosaic, however, even by heat therapy seeds were not completely freed from infection. Sharma and Varma (1975 b) found appreciable reduction in seed transmission of cowpea banding mosaic disease through seeds of cowpea after treating the infected seeds at 65°C for 15 minutes followed by 2, 4 or 8 days incubation at 30°C. Use of systemic and non-systemic insecticides has also been tried to reduce the field spread of several stylet-borne viruses with varying results (Swenson **et al.** 1954; Sharma and Varma, 1972; Burt **et al.** 1960; Nirula and Kumar, 1969). In the present studies experiments were conducted to compare the efficacy of heat therapy of infected seeds alone and/or in combination with side treatment of granular insecticide on the field spread of CpBMV and yield of cowpea.

MATERIAL and METHODS

For heat therapy, random samples of healthy and virus infected seeds of cowpea cv. Pusa Dophasli were given dry heat at 65°C for 15 minutes in an oven and later incubated at 30°C for 4 days. Untreated healthy and diseased seeds served as control. These seeds were sown in the field on ridges during kharif 1973 and summer and kharif 1974 seasons. The data were recorded as percentage of seed germination, transmission, yield and the incidence of the disease.

In the 2nd experiment heat treatment of infected seeds and side application of granular incesticide disulfoton (0, 0-diethyl-S-2 (ethylthio) ethyl phosphorodithioate) were tested. Diseased seeds of cowpea were treated with dry heat as in the first experiment. Two plots each measuring 6m x 6½ m were sown with heat treated and untreated seeds. Each plot consisted of 24 rows. Plot having treated seeds was further divided into two sub-plots, one sub-plot was given disulfoton granules O 2 Kg ai/ha as side application about 6 days after sowing while another sub-plot was left as such. Percentage of seed germination and virus transmission were recorded separately in each treatment. 45 days after incesticidal application height of plants was recorded from 20 plants selected at random from each treatment. For yield estimation, 3 rows each having 25 plants were selected at random from each treatment. Virus infection was recorded at regular intervals starting soon after germination.

RESULTS

Effect of heat therapy: There was siginficant decrease in the percentage of seed transmission of Cp-BMV in all the experiments (Table 1, 2) conducted during 1973 - 1974. During 1973 kharif season the per cent germination of untreated healthy and diseased seeds and treated healthy and diseased seeds was 81.94, 86.11, 67.22 and 61.37 respectively whereas seed transmission in treated seeds was 0.90 per cent as compared to 14.06 per cent in control (Table 1). The yield of cowpea seeds was also influenced by heat treatment. The per cent increase in yield over untreated diseased seeds was 53.4, 33.8 and 19.3 in healthy untreated, healthy treated and diseased treated, respectively. However, healthy treated seeds yielded about 19.6 per cent less than healthy untreated seeds (Table 1). The virus incidence was almost proportioned to the percentage of seed transmission. Maximum incidence of viruses recorded at the end of the experiment was 29.74 per cent in untreated seeds whereas only 1.96, 2.23 and 4.79 per cent infection was recorded in healthy, healthy treated and diseased treated seeds, respectively (Table 2). During 1974 summer and kharif seasons also the per cent germination of treated healthy and diseased seeds was higher than 70 per cent as compared to 85.00 - 91.13 per cent of diseased untreated seeds (Table 2). The increase in yield over untreated diseased seeds was 20.2 - 22.4 per cent, 41.2 - 54.4 per cent and 71.5 - 74.3 per cent in diseased treated, healthy treated and healthy untreated seeds, respectively. The virus infection was again found to be proportional to seed infection. However, spread was quicker and more during kharif season than in summer.

Effect of heat therapy of diseased seeds and side dressing of insecticide: Seed germination of heat treadet seeds was reduced by about 16 per cent and seed transmission by about 11 per cent as compared to control (Table 3).

There was not much difference between the heights of the plants from heat treated or untreated seeds but insecticidal application increased the height by about 100 per cent. Yield of cowpea seeds/plant was also increased by more than 200 per cent when disulfoton granules were applied as side treatment. Heat treatment alone increased the yield over untreated diseased seeds by about 37 per cent (Table 3). The virus spread was greatly reduced by insecticidal application. By the end of the experiment, 7.33 per cent of plants got infected in insecticidal treated plot whereas 21.00 and 39.00 per cent infection was noticed in only heat treated and untreated diseased seeds, respectively.

DISCUSSION

CpBMV was appreciably inactivated by dry heat in the seeds of cowpea. However, the germination of seeds was adversely affected by heat treatment. The adverse effect on germination was more when seeds from diseased plants were treated than in case of seeds from healthy plants. Except for kharif 1973, the per cent germination of treated seeds was more than 70 per cent. It is obvious that heat denaturation point of virus within seed is quite close to the viability point of the seed and, therefore, a difficult balance to strike. The secondary spread of CpBMV was also greatly influenced as has been observed earlier (Sharma and Varma, 1982 b) by the extent of seed transmission. The final incidence of CpBMV in plots sown with untreated diseased seeds was more than (% 20) while in treated seeds it was less than (10 %) in al the experiments conducted during 1973 - 1974. Moreover, plants raised from treated diseased seeds gave 19.3 - 22.4 per cent higher yield than untreated diseased seeds. When disulfoton granules were also applied as side treatment the difference was more marked. Height of plants raised from heat treated diseased seeds receiving disulfoton was almost two-fold as compared to untreated or heat treated alone. Heat treatment alone and in combination with insecticidal application increased the yield by about 37 and 200 per cent over untreated diseased seeds. Insecticidal treatment also reduced the spread of CpBMV and only 7.33 per cent plants got infected as compared to 21.00 and 39.00 per cent in heat treated alone and untreated seeds, respectively. Obviously, insecticidal treatment checked transmission of CpBMV within the plot thus considerably reducing the final incidence of the virus. Marked increase in yield from insecticide treated plots cannot be assigned completely to check the virus spread but damage due to other insects must also have been reduced. Moreover, granular insecticides are known to be fungistatic and nematicidal (Ram **et al.** 1971; Sinha et al. 1980; Singh and Reddy, 1981; Sharma, 1982).

ACKNOWLEDGEMENTS

Authors thank the Head, Division of Mycology and Plant Pathology for providing the necessary facilities and the Director General, Indian Council of Agricultural Research, New Delhi, for awarding a Senior Fellowship to the first author.

Ö Z E T

İNFEKTELİ TOHUMLARIN SICAKLIKLA MUAMELESİNİN VE GRANÜL İNSEKTİSİD UYGULAMASININ BÖRÜLCE BANT MOZAYIK VİRUSUNUN TARLADA YAYILMASI VE BÖRÜLCE VERİMİ ÜZERİNE ETKİSİ

Börülce bant mozayık virusu (Cp BMV) ile infekteli börülce tohumlarının 65°C kuru sıcaklıkta 15 dakika tutulmasından sonra 30°C de 4 gün inkube edilmesi virusun tohumla taşınmasını % 13.13 - 27.4 den % 0.9 - 3.33 e; tohum çimlenmesini de % 85.0 - 91.13 ten % 61.37 - 71.44 e düşürmüştür. Tohumların sıcaklıkla muamelesi CpBMV'nun tarladaki yayılmasını % 4.79 - 9.17 ye düşürmüştür. Kontrolda tarladaki yayılma % 23.72 - 29.74 olmuştur. Sıcaklıkla muamele edilmiş tohumlardan elde edilen tohum ürünü, muamele edilmemiş tohumlardan elde edilen üründen % 19.3 - 22.4 oranında daha yüksek olmuştur. İnfekteli tohumların sıcaklıkla muamelesi disulfoton granül kenar ilaçlamasıyla birlikte uygulandığında bitki boyunda ve tohum ürününde önemli bir artış ve CpBMV tarla yayılmasında da önemli bir azalış ile sonuçlanmıştır.

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Table-1: Effect of heat treatment of cowpea seeds on germination and seed transmission of CpBMV and seed yield

Year and season	Treatment	Number of seeds sown	Percentage		Seed yield/ Q+1/ha	Per cent increase in yield
			Seed germination	Seed transmission		
1973	Healthy	600	81.94	0	1.182	53.4
Kharif	Healthy treated	600	67.22	0	1.0.32	33.8
	Diseased treated	600	61.37	0.9	0.920	19.3
	Diseased (control)	600	86.11	14.06	0.771	—
1974	Healthy	300	87.53	0	0.969	71.5
Summer	Healthy treated	300	76.76	0	0.798	41.2
	Diseased treated	300	70.10	3.33	0.692	22.4
	Diseased (control)	300	85.00	24.70	0.565	—
Kharif	Healthy	300	89.63	0	1.360	74.3
	Healthy treated	300	79.22	0	1.205	54.4
	Diseased treated	300	71.44	1.39	0.938	20.2
	Diseased (control)	300	91.13	13.13	0.780	—

Table-2: Effect of heat treatment of cowpea seeds on field spread of CpBMV

Year and season	Treatments	Number of plants observed at each time	Percentage of plants infected (days after sowing) 15	30	45	60	75	90
1973	Healthy	1475	0	0.40	0.67	1.08	1.55	1.96
Kharif	Healthy treated	1210	0	0.41	0.66	0.90	1.32	2.23
	Diseased treated	1105	0.9	1.71	2.53	3.25	3.71	4.79
	Diseased (control)	1550	14.06	14.77	15.55	17.09	18.03	29.74
1974	Healthy	788	0	0	0	0.38	0.63	0.76
Summer	Healthy treated	691	0	0	0.43	0.43	0.72	1.01
	Diseased treated	631	3.30	4.26	6.18	6.18	6.55	7.55
	Diseased (control)	765	24.70	26.64	29.01	29.01	29.40	30.18
Kharif	Healthy	807	0	0.12	0.74	1.36	2.60	4.96
	Healthy treated	713	0	0.42	0.70	1.40	2.38	4.34
	Diseased treated	643	1.39	2.49	2.95	4.51	6.37	9.17
	Diseased (control)	822	13.13	14.72	15.32	18.36	20.43	23.72

Table-3: Effect of heat treatment of infected seeds and side dressing of disulfoton on virus infection and yield of cowpea cv. Pusa Dophasli

Treatments	Number of seeds sown	Percentage of seed		Height of plants (cm)	Seed yield/plant (g)	Percentage of plants infected at regular intervals (15 days)			
		Germination	Transmission*			I	II	III	IV
1. Heat treated seeds	475	71.2	2.33	51.70	5.44	2.33	6.33	13.00	21.00
2. Heat treated seeds + disulfoton	475	71.2	1.33	95.80	13.00	1.33	3.00	4.00	7.33
3. Control (Untreated diseased seeds)	750	87.98	13.40	48.43	4.03	13.40	20.60	30.20	39.00

* Calculated on the basis of plants developing symptoms

J. Turkish Phytopath., Vol. 12, No. 2-3, 113-123, 1983.

Die Verbreitung der Gerstenstreifenkrankheit (**Drechslera graminea** «Rab. ex Schlecht.» Shoemaker) in Mittelanatollien und Ihre Künstliche Inokulationsmethoden

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ZUSAMMENFASSUNG

Für die Streifenkrankheiten (**Drechslera graminea** «Rab. ex Schlecht.» Shoem.) an Gerstenpflanzen festzustellen, wurden im Jahre 1976 im Mittelanatolien Untersuchungen durchgeführt. Dieser Untersuchungsgebiet kann es werden, dass durch die Erreger ansehnliche Schaeden an Gersten verursacht wurden. So trat im Mittelanatolien **D. graminea** in mittlerer Intensitaet auf. Hiermit wurde im Mittelanatolien eine durchschnittliche Krankheitsintensitaet von 5.99 % festgestellt. Ausserdem wurden sie verschiedene Naehrboden verwendet. Der Pathogen wurde am besten Myzelialwachstum auf PDA mit queller Vitamine 0.1 % nachgewiesen. In dieser Untersuchungen wurden auch 8 Inokulationsmethoden benutzen.

EINLEITUNG

Es wurde festgestellt, dass einige Krankheiten die Gesamtproduktion an Gersten faellen hat. Under diesem auch eine Krankheit ist **D. graminea.** Dieses Pathogen wird fast überall auf der Gerstenanbauflaeche der Welt nachgewiesen und sie wurde ansehnliche Schaeden an Gersten verursacht (Butler and Jones, 1949; V- Bourgin, 1949; Sprague, 1950; Dickson 1956; Lee, 1957; Mathur et al., 1964; Rasulev and Krovtsova, 1970; Zekovic, 1970; Prasad et al., 1976). Der Fungus wurde in der Türkei zum erstenmal von Bremer et al. (1947) in İzmir und in Ankara festgestellt. Danach wurde von Karel (1958) registriert, dass diesem Pathogen in der Türkei nur für die Küstegebiet wichtigste gewesen war. Zumal wurde von Göbelez (1956) diese Krankheit im Jahre 1954 und 1955 in Eskişehir, Akşehir (Konya) und in Ankara beobachtet. Die Streinfenkrankheit hat auch İren (1962), Karaca (1968) und İyriboz (1970) geschrieben werden. Der erste Zweck diezer Untersuchung ist die Verbreitung, ökonomische Bedeutung von **D. graminea** im Mittelanatolien an Gersten nur untergeordnete Bedeutung zu besitzen hat. Gegen das Pathogen soll man die Bekaempfung durchführen. Um diese durchzuführen, benötig es Intensivsuntersuchungen. Dazu ist erforderlich, dass die Verbreitung, die Krankheitsintensitaet und die Bedeutung des Pathogens an Gerstenanbauflaechen festgestellt werden muss.

MATERIAL und METHODEN

1. Untersuchungen im Freiland

Um die erkankten Pflanzen von **D. graminea** zu sammeln wurde in den Monaten April - Mai 1976 des Mittelanatolien besucht. Die Untersuchung wurde nach «Systematische - Vorbildungsmethode» durchgeführt (Bora and Karaca, 1970). Die Untersuchungsreise wurde den folgende Weg entlang gemacht.

A) Ankara, Eskişehir, Afyon, Burdur, Akşehir, Sarayönü, Polatlı und Ankara.

B) Ankara, Konya, Aksaray, Nevşehir, Kayseri, Sivas, Yozgat, Kırşehir, Bâlâ und Ankara.

C) Ankara, Çankırı, Çerkeş, Kızılcahamam, Nallıhan, Ayaş und Ankara.

Die Proben wurden im Mittel 50-100 Schritte vom Feldrand ausgezogen. Je nach der Grosse des Feldes wurden 1 bis 5 Proben auf den Gerstenanbauflaeche entnommen. Darüberhinaus wurde in jedem Feld erkrankte Pflanzen und die prozentuale Krankheitsintensitaet auch für jede befallene Pflanze gefunden. Die prozentuale Krankheitsintensitaet wurden nach Mohammad and Mahmood (1974a, 1974b, 1976) und im Mittelanatolien die durchschnittliche prozentuale Krankheitsintensitaet nach Grainger (1967) festgestellt. Die Arbeit wurde angefangen, als die Gerstenpflanzen die Seitentriebe bekamen und wurde nach 20 Tagen Zwischenraum 3 mal weiderholt.

2. Untersuchungen im Labor

Die erkrankten Gerstenpflanzenproben wurden im Labor zuerst im Binokular and auch danach im Mikroskop studiert. Die aus den Feldern mitgenommenen Gerstenblaettern, die zum Teil Schwarzbraun aussehen wurden in ca. 2 cm lange Blattstücke abgeschnitten und danach mit 1 % ige Chlorlauge (NaOCl) 2-3 Minuten oberflaechlich desinfiziert und mit sterilem Wasser 3 mal gut gespüllt. Um den Erreger su isolieren wurden diese erkrankten Blattstücke 4-5 Tage Lang bei 22 + 2°C, in eine Feuchtkammer gebracht. Diese Feuchtkammer wurde 12 Std. pro Tag Beleuchtet. **D. graminea** wurde nach Ellis (1971) und Chidembaram et al. (1973) identifiziert.

Für die Feststellung der Naehrbodenwirkung auf das Wachstum von **D. graminea** auf die unterschiedliche Medium bei 25°C, wurden 14 verschiedene Naehrboden untersucht.

1. MEA (20 g Malt Exrakt + 15 g Agar + 1 lt Wasser)
2. PUA (20 g Reismehl + 15 g Agar + 1 lt Wasser)
3. SAY (15 g Agar + erkrankte Gerstenbaettern + 1 lt Wasser)
4. HEA (200 g Karotte Exrakt + 15 g Agar + 1 lt Wasser)
5. PDA (Kartoffel — Dextrose — Agar)

6. SA (15 g Agar + 1 lt Wasser)
7. PA (200 g Kartoffel Exrakt + 15 g Agar + 1 lt Wasser)
8. MUA (20 g Maismehl + 15 g Agar + 1 lt Wasser)
9. Fenilalanin (1 lt PDA + 0.1 % ige Fenilalanin)
10. Amonium nitrate (1 lt PDA + 0.1 % ige Amonium nitrate)
11. Asparagin (1 lt PDA + 0.1 ige Asparagin)
12. Thiamin (1 lt PDA + 0.1 ige Thiamine)
13. Inositol (1 lt PDA + 0.1 ige Inositol)
14. Pyridoksin (1 lt PDA + 0.1 ige Pyridoksin)

3. Untersuchungen im Gewaeckshaus

Die Samen - und Saemlingsinokulationen wurden nach acht verschiedanen Methoden durchgeführt .Der Versuch hatte fünf Wiederholungen. Bei den Inokulationsversuchen wurden eine Gerstensorte Manchuria verwendet. Diese Sorte zeigt die anfaellige Reaktion gegen **D. graminea** nach Kline (1972). Vor den Inokulationen wurden alle Gerstenkörner mit 1 % ige Chlorlauge oberflaechlich desinfiziert. Danach wurde im je 40 ml Inokulumsuspention 1 tropfen Tween- 40 zugesetzt (Keeling, Bantari ,1975; Yeğen 1976; Aktaş, Bora, 1981).

Inokulationsmethoden:

1. In den 100 ml Erlenmayer wurden 15 g Weizenkörner und 15 ml Wasser zugesetzt und 15 Minuten otoklaviert. Danach wurde eine 2 ml Myzelsuspention von **D. graminea** in jede Erlenmayer zugesetzt. Nach der 5 taegigen Inkubation wurden 10 Gerstenkörner in jede Erlenmayer eingelegt und im Inkubationsraum bei 20-24°C, 4 Tage Lange bebrütet. Danach wurden die Gerstenkörner mit der Inhalt jeder Erlenmayern in den Töpfen ausgesaeet (Arny, Shands, 1942; Kline, 1972).

2. In den Petrischalen wurden auf den PDA Tage Lange **D. graminea** Kulturen gewachst. Auf diese wurden sie pro Petrischalen 10 Gerstenkörner ausgelegt und mit dem gleichen Kultur bedeckt. Danach wurden sie 72 Stunden Lange bei 25°C im Labor inkubiert. Spaeter wurden sie in den Topfen mit allem Kulturen ausgesaeet (Houston and Oswald, 1948; Mohammad and Mahmood, 1974).

3. Die in PDA voll bewachsenen 12 Tage alten **D. graminea** Kulturen wurden in je einen Topf bis zu 3-5 cm Tief der Erde gelegt. Auf diese wurden pro Topf 10 Gerstenkörner ausgelegt und mit dem gleichen Kultur bedekt und darauf mit Erde beschichtet.

4. Die Gerstensamen wurden in einer Feuchtkammer gekeimt. Die Spitze der Keimlingen wurden in ca. 2 mm abgeschnitten und in einer Konidiensuspention von 10^5 Konidien/ml in einem Desikator mit Vakuum (26-27 inç Hg) 5 minuten Lange ausgelegt. Danach

wurden diese Keimlingen in den Töpfen (je 10 Stück) ausgesaeet. Die Konidien von **D. graminea** wurden von die erkrankte Gerstenblaetter in der Feuchtkammer mitgenommen.

5. Die Gerstensamen wurden in einer Myzelialsuspention 24 Std. Lange bei 25°C gebliben. Danach wurden sie in den Topfen ausgesaeet.

6. Die Gerstensamen wurden in einer Feuchtkammer gekeimt. Nach der Keimung wurden diese Keimlinge in einer Myzelialsuspention sehr leicht umgerührt. Danach wurden sie in den Töpfen ausgesaeet.

7. Die Gerstenkörner wurde 24 Stunden Lange bei 25°C in einer Myzelsuspention gebliben. Danach wurden sie 72 Std. Lange bei 25°C in den Feuchtkammer inkubiert. Danach wurden sie in den Töpfen (je 10 Stück) ausgesaeet (Zekovic, 1971; Mohammad and Mahmood, 1974).

8. Die Gerstenkörner wurden in einer Myzelialsuspention im Desikator 5 Minuten mit Vakuum (26-27 inc Hg) gebracht. Danach wurden sie im Labor 24 Std. bei 25°C liegen lassen. Spaeter wurden sie in den Topfen ausgesaeet (Damgacı, Baykal, 1980).

ERGEBNISSE und DISKUSSION

Erste Abteilung dieses Arbeits wurde vom 6.4.1976 bis 25.5.1976 durchgeführt. In Untersuchungen wurden 213 Gerstenanbaufelder studiert.

Tabella 1. Im Mittelanatolien Verbreitungen und durchschnittliche Krankheitsintersitaet im Feld von **D. graminea.**

Provinz	Wirtpflanzen	Zahl der gesunde Feld	Zahl der befallene Feld	Krankheitsintensitaet im Feld (%)
ANKARA	Gerste	15	17	2.24
AFYON	»	12	4	8.69
BURDUR	»	5	5	14.90
ÇANKIRI	»	—	5	8.93
ESKİŞEHİR	»	12	4	5.46
ISPARTA	»	12	5	8.40
KAYSERİ	»	4	2	6.38
KIRŞEHİR	»	4	3	14.75
KONYA	»	55	7	5.33
NEVŞEHİR	»	5	4	5.80
NİĞDE	»	3	5	8.09
SİVAS	»	14	3	3.86
YOZGAT	»	4	4	5.42

Im Untersuchungsgebiet wurden von 213 studierten Gerstenanbaufeldern nur in 68 Feldern **D. graminea** festgestellt. Wie die Tabella 1 beobachtet, ist **D. graminea** auf der Gerstenanbauflaeche fast überall im Mittelanatolien Verbreitung festgestellt worder; daraus kann geschlosen werden, dass durch die Art ansehnliche Schaeden an Gerste verursacht wurden. Im Mittelanatolien wurden bei Untersuchungen im 1976 Jahre 31.0 % befallene Gerstenanbaufelder mit **D. graminea** nachgewiesen. Auf diesen Grunde hatte das Untersuchungsgebiet grosse Bedeutung gehabt. In diesem Jahre ist im Untersuchungsgebiet das Fungus in mittlerer intensitaet aufgetrat worden. Das Pathogen wurde fast überall in Gebieten auf der Gerstenpflanzen festgestellt. Im Gerstenfeldern lag die durchschnittliche Krankheitsintensitaet zwischen 1.35 % 29.6 %. Im Mittelanatolien wurden eine durchschnittliche Krankheitsintensitaet von 5.99 % festgestellt. Der Erreger scheint zwieschen die Gattung Drechslera im Mittelanatolien als Blattfleckenerreger an Gerste nur untergeordnete Bedeutung zu besitzen.

Im vitro wurden 14 verschiedene Naehrboden benutzen. **D. graminea** wurden auf alles Naehrboden am besten Luftlebigmyzelialwachstum und auf verschiedenen Naehrboden sehr wenig sporulationen gebildet (Tabella 2 und Abb. 1). Auf Wasser - Agar mit erkranten Gerstenblaettern gedeiht sporulationen von dem Fungus am besten. Dieses Ergebnis stimmt von Hauston und Oswald (1946). **D. graminea** wurde nachgewiesen, dass sie auf alles Naehrboden bei 25°C Rundliche entwickeln sind (Abb. 2). Ihrer Farbe auf Naehrboden wurden bei 25°C von Inokulationen nach 6-8 Tagen grau, hell - oder dunkelrot zeigen können.

Die Symptome von **D. graminea** kann sicher in allen Gerstenpflanzen beobachten werden, z.B. von dem Halmbasis bis zur Aehren. Deswegen kann Die Erreger sowohl in der Konidienform als auch der Myzelial auf der Blaettern, Blaettscheiden und stroch von Gerstenpflanzen überwintern werden. Das Krankheitsbild ist an der Blaettscheiden und auf der Blatterflaeche zuerst die Streifenartige gelb, dann braune Verfaerbung angesehen werden. Nach der Aussaat Keimt mit dem Gerstensamen auch das dauermyzel des Pathogens, befaellt die junge Keimpflanze direkt. Sie durchdringt in der junge Gerstenpflanzen als systemische (Gaeumann, 1946; Butler and Jones, 1949; Chıdambaram et al., 1973). Dafür kann die Symptome von **D. graminea** im allen Gerstenpflanzen beobachten werden (Abb. 3, 4 und 5). Auf dem gebraunte Blaettern und Blattscheiden wurden im Binokular die Konidientraeger und die Konidien ganz deutlich nachgewiesen. Es wurde festgestellt, dass erkrankte Gerstenpflanzen als gesundene sehr früh vertrocknet und getötet hat. Die Konidientraeger haben die dunkel Braun. Auf den Konidientraegern kann man immer 3 oder 5 liege Konidienkette sehen (Abb.

6). Die Konidien wurden im Mikroskop elipsoide und sehr ordnung des Konidienwaendes gezeigt. Die grundzelle des Konidiens ist rundliche und hell farbige als terminale Konidienzelle. Sie kann von Hallbraun bis olivbraun oder dunkelbraun farbig nachweisen werden. Sie ist 2-4 Septazahl. Die Konidiengrosse ist 30.0 - 75.0 x 11.2 - 18.7 mikronen. Sie wurden wesentlichen die beiden Konidienspitzen gekeimt (Abb. 7).

D. graminea erfolgt die Verbreitung Hauptsaechlich durch infizierte Samen (Gaeumann, 1946; Lee, 1957; Teviotdale and Hall, 1976; Metz and Scharen, 1979). Saatgutinfektionen werden besonders in Jahren aufgetrat. Die Niedrige Bodentemperaturen hat die Entwicklung des Pathogens begünstigt (Arny and Shands, 1942; Prasad et al., 1976; Teviotdale, Hall, 1976).

Es wird die Möglichkeit Künstlicher Infektion der Gerstenkörner mit Konidien und mit Myzelial von **D. graminea** nachgewiesen. In den Versuch wurden 8 verschiedene Inokulationsmethoden verwendet (Tabella 3 und 4). Erste und Zweite Inokulationsmethoden wurden am besten Ergebnis gewonnen. Die starker Körnerbefall wurde besonders bei Gerstenkörner. Manchuria ersten und zweiten Inokulationsmethoden am besten aufgetrat. Die anderen Inokulationsmethoden wurden die meisten mittelstarker Befall festgestellt (Tabella 4). Manchuria zeigt die anfaellige Reaktion gegen **D. graminea** nach Kline (1972).

Tabella 4. Durchschnittlicher prozentualer Gerstenpflanzen bei unterschiedlichen Inokulationsmethoden zur die Samen und Saemlingen mit **D. graminea**.

Inokulations-methoden Nummer	Durchschnittliche Prozentuale Krankheitserscheinung	Duncan Test (nach 1-5%)	Gruppen
1	86.1	A	1
2	71.1	A	
3	22.0	B	2
4	18.1	BC	3
5	10.7	BCD	4
6	3.9	CD	5
7	2.9	D	6
8	1.9	D	

Venn die infizierte Gerstensamen mit **D. graminea** und die Klimabedingungen des Mittelanatolien für die Entwicklung und ausbreiteten Eigenschaften des Streifenkrankheitserregers als sehr günstig ansehen werden können, kann sie immer fast überall im Mittelanatolien auf der Gerstenanbauflaeche hervorrufen werden.

Ö Z E T

ORTA ANADOLU BÖLGESİNDE ARPA ÇİZGİ HASTALIĞI «Drechslera graminea (Rab. ex Schlecht.) Shoemaker»'NIN YAYILIŞI VE INOKULASYON METOTLARI

Orta Anadolu bölgesinde arpa çizgi hastalığının saptanması için bu çalışma yürütülmüştür. Hastalığın bölgemizde zararlı olduğu görülmüştür. Yapılan çalışmada etmenin, Drechslera yaprak lekesi hastalıkları içerisinden, arpada orta derecede entansite oluşturduğu bulunmuştur. Böylece Orta Anadolu bölgesinde, ortalama hastalık entansitesi % 5.99 olarak saptanmıştır. Fungusun çeşitli besi ortamlarındaki miselyal gelişme durumları ve sporulasyon oluşturma yetisine bakılmıştır. Ayrıca 8 farklı inokulasyon yöntemi kullanılarak en iyi inokulasyon yöntemi saptanmıştır.

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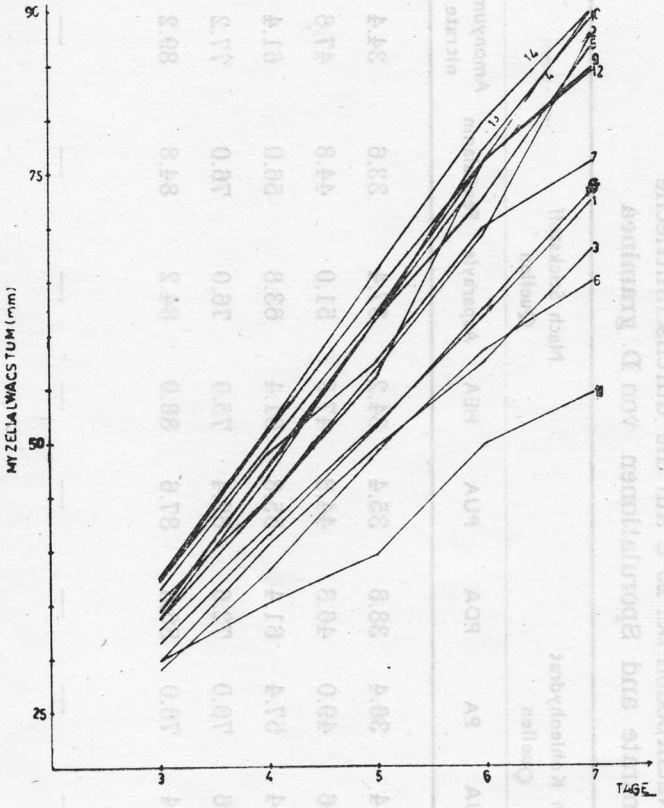

Abb.1. Durchschnittliche Myzelialwachstuurate von **D. graminea** auf unterschisdlicher Naehrboden bei 25°C.

Tabella 2. In verschiedene Naehrboden bei 25°C auf die durchschnittleche Myzelialwachstumsrate and Sporulationen von **D. graminea**

	Nach Kohlenhydrat Quellen							Nach Stickstoff Quellen				Nac Vitamin Quellen		
	SA	SAY	MEA	MUA	PA	PDA	PUA	HEA	Asparayla	Fenilalanin	Amonyum nitrate	Thiamin	İnositol	Pyridaksin
3	29	29.8	32.8	31.4	36.4	38.8	35.4	34.2	37.4	33.6	34.4	29.8	37.2	37.6
4	38	40.6	42.4	41.6	49.0	46.8	44.8	47.8	51.0	44.8	47.6	35.2	49.6	51.2
5	49	49.6	51.6	51.4	57.4	61.4	55.8	61.4	63.8	56.0	61.4	39.6	61.8	65.8
6	58.6	57.6	61.8	62.6	70.0	72.6	69.4	75.0	76.0	76.0	77.2	49.8	76.0	79.8
7	65	68	72.4	73.4	76.0	86.8	87.6	88.0	84.2	84.8	89.2	54.6	90.0	90.0
Beider Vorbildung Sporulationen	++	++	—	—	—	—	—	—	—	—	—	—	—	—

Tabella 3. Dinwirkung von Unterschiedlichen Inokulationsmethoden auf den prozentsatz der befollenen Genstenpflanzen und auf den prozentvole Krankheitserscheinung mit **D. graminea**

Inokulations-methoden	Zahl der Inokulierten Gerstenplanzen					Zahl der befallenen Genstenpflanzen					Zahl der befallenen Gerstenpflanzen in Prozent	Prozentaole Krankheitserscheinung					
	Viederholungen					Wiederhdungen						Wiederholungen					Durchschnitt-lich (%)
	1	2	3	4	5	1	2	3	4	5		1	2	3	4	5	
1	10	10	10	10	10	9	9	10	10	10	96	77.0	68.5	95.0	95.0	95.0	86.1
2	10	10	10	10	10	5	10	6	8	10	78	32.5	95.0	57.0	76.0	95.0	71.1
3	10	10	10	10	10	2	1	3	2	7	26	2.0	9.5	22.0	10.0	66.5	22.0
4	10	10	10	10	10	3	2	4	1	2	24	22.0	15.0	29.5	9.5	14.5	18.1
5	10	10	10	10	10	2	1	2	1	3	18	6.0	7.5	8.5	3.0	28.5	10.7
6	10	10	10	10	10	—	—	1	1	1	6	—	—	5.0	9.5	5.0	3.9
7	10	10	10	10	10	—	—	—	1	1	4	—	—	—	5.0	9.5	2.9
8	10	10	10	10	10	—	—	—	—	1	2	—	—	—	—	9.5	1.9

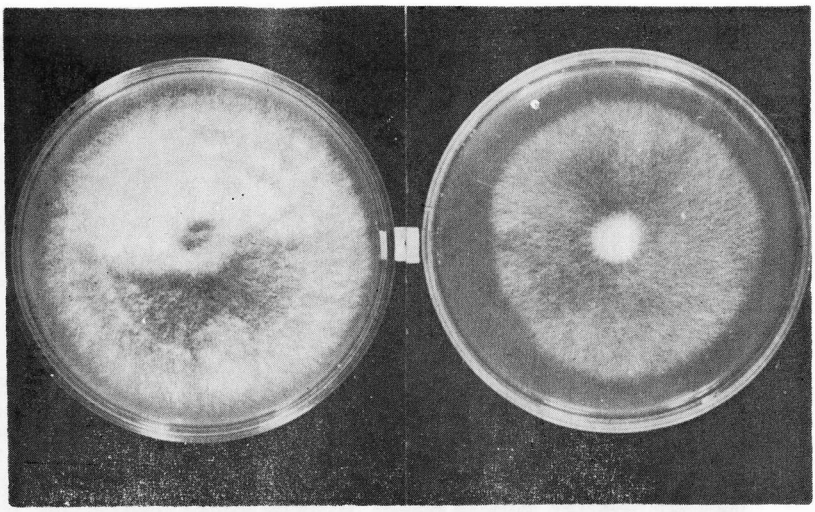

Abb.2. Myzelialwachstum von **D. graminea** bei 25°C auf dem PDA - (Links) und MEA (Rechts) - Naehrboden.

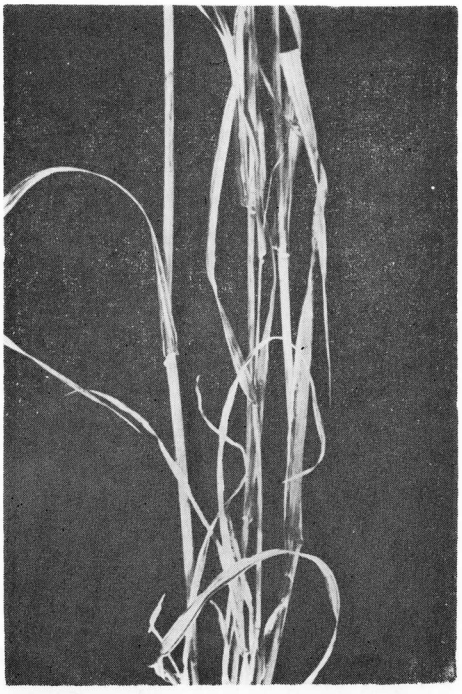

Abb.3. Krankheitsbild von **D. graminea** an der Blattscheide und Blattflaeche bei Gerstenpflanzen.

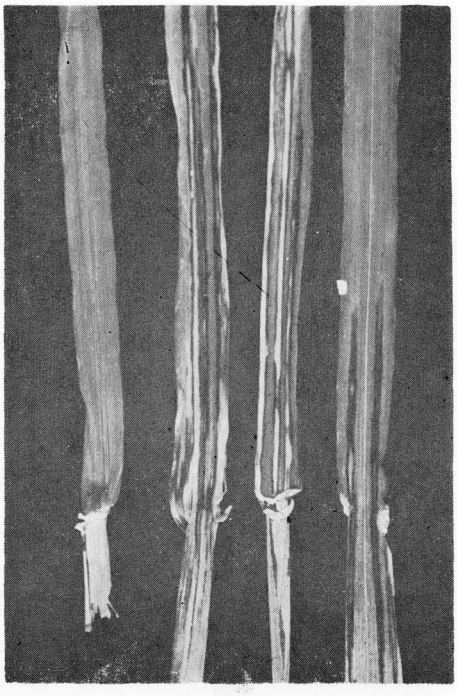

Abb.4. Streifenkrankheiten auf den Gerstenblatter.

Abb.5. Krankheitsbild von **D. graminea** an Aehren bei Gerstenpflanzen.

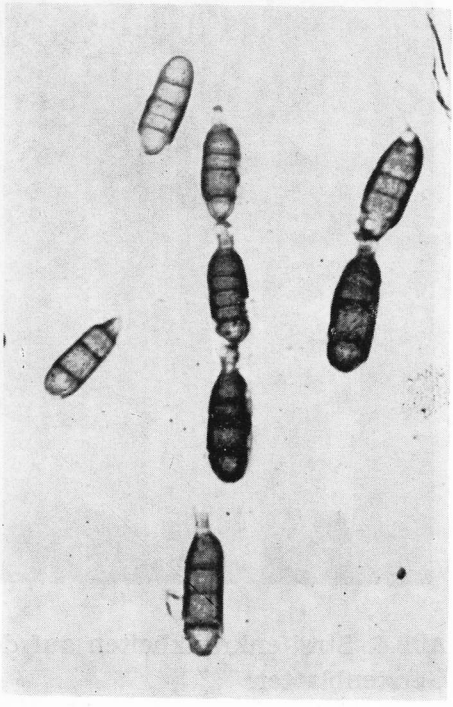

Abb.6. Konidienkette auf den Konidientraegern (X 400).

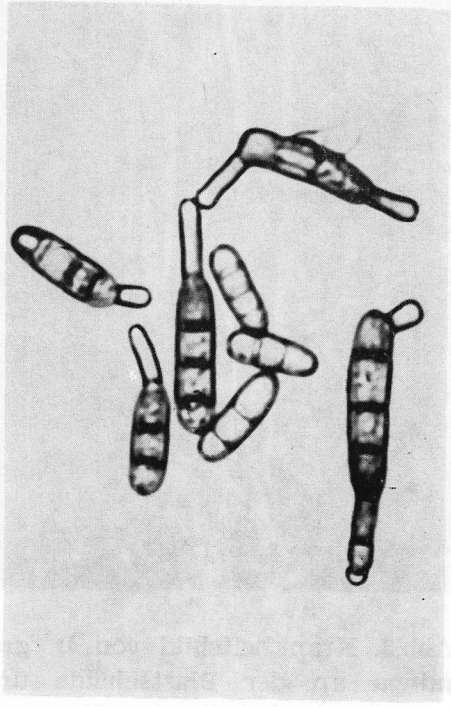

Abb.7. Die Konidien von **D. graminea** (X 500).

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